Cranfield UNIVERSITY

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Analysis Of The Effects Of Air Transport Liberalisation On The Domestic Market In Japan

COLLEGE OF AERONAUTICS

PhD Thesis

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Academic year 2006-2007

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May 2007

This thesis is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

Abstract

This study aims to demonstrate the different experiences in the Japanese domestic air transport market compared to those of the intra-EU market as a result of liberalisation along with the Slot allocations from 1997 to 2005 at Haneda (Tokyo international) airport and to identify the constraints for air transport liberalisation in Japan. The main contribution of this study is the identification of the structure of deregulated air transport market during the process of liberalisation using qualitative and quantitative techniques and the provision of an analytical approach to explain the constraints for liberalisation. Moreover, this research is considered original because the results of air transport liberalisation in Japan are verified and confirmed by Structural Equation Modelling, demonstrating the importance of each factor which affects the market.

The Tokyo domestic routes were investigated as a major market in Japan in order to analyse the effects of liberalisation of air transport. The Tokyo routes market has seven prominent characteristics as follows: (1) high volume of demand, (2) influence of slots, (3) different features of each market category, (4) relatively low load factors, (5) significant market seasonality, (6) competition with high speed rail, and (7) high fares in the market. These characteristics particularly stand out when comparing to routes serving the UK, including UK domestics.

Moreover, the outcomes of the analysis demonstrated the three significant different experiences compared to the intra-EU market serving the UK as a result of liberalisation: (1) decreased demand, (2) increased fares and (3) new entrants' failures. Although competition among airlines seemed to be experienced in the beginning of the process of liberalisation, most of new entrants are governed by the control of network carriers, and this has affected the market, which resulted in fares to increase and demand to drop, particularly in the low demand markets. However, several markets on the Tokyo routes have been developed by low fares as a result of competition with high speed rail such as the Tokyo-Hiroshima and Okayama routes.

The key objectives of the slot allocation policies were the promotion of competition and the improvement of consumer's convenience with safety assured. They have not been accomplished yet because of several constraints.

The constraints for liberalisation in Japan were discovered by comparing with the virtuous market flow circulation in the EU. The results of liberalisation in Japan have the opposite direction flow because airlines provide "high yield products", which are caused by high cost structures of air transport in Japan, compared to the "high productivity products" of the EU.

It is very difficult to promote a real basis for competition among airlines and HSR in Japan. Governments have been developing the transportation network of both rail and air in line with the growth of the Japanese economy under the name of competition policy since 1960s. The overestimated airport planning and demand by the government based on the bubble economy in Japan caused high cost structures as well.

Furthermore, the Japanese Government has been reluctant to implement significant changes and face the impacts of deregulation in order to avoid the bankruptcies of airlines experienced in other liberalised markets. Therefore, the intensity of competition in the Japanese air transport has been interpreted and implemented differently from those of other areas as a result of this protective policy towards Japanese airlines. The standard of competition has not reached the level of other industries like manufacturing, which have been competing in the global market. It seems that Japanese government policy has accomplished its objective which forced two network carriers (JAL and ANA) to change the structure of organisations, labour cost and their companies' hierarchical cultures, although the intensity of change is not enough compared with other airlines outside Japan as a result of liberalisation.

Lower fares and reduced costs are crucial in order to develop demand and switch the direction of the market flow in Japan, as evidenced in the intra-EU market.

A real basis for competition is expected when the number of slots will increase at Haneda airport in 2009. In order to prepare for the next step of liberalisation and international competition, fundamental changes and innovation should be implemented by removing constraints in the Japanese air transport system.

Acknowledgements

I would like to express my appreciation to all people who have kindly supported my research both in academic research and in life in England. Without their encouragement, I could not have accomplished my PhD study at Cranfield.

First of all, I would like to state my greatest gratitude to my supervisor Dr. George Williams in great reverence. His thoughtful suggestions and support have guided me throughout the process of this study. Without his direction and encouragement, it would have been difficult to complete this study.

Furthermore, my great appreciation is expressed to Professor Graham Braithwaite and Dr. Fariba Alamdari for providing me the opportunity and grant to continue my study with their great encouragement. My gratitude is also extended to Dr. Romano Pagliari, Dr. Keith Mason, Dr. Peter Morrell, Mr. Ian Stockman, Mr. Andy Foster, Mr. Ralf Anker, Mrs. Barbara McGowan and all staff, and many friends of the Department of Air Transport.

I would like to express my gratitude to Professor Teruo Takahashi and Mrs. Yaeko Nishihashi at Waseda University in Tokyo, Japan for their encouragement and guidance in this study for a long time. In addition, I would like to sincerely thank the late Mr. Masanori Honjyo, the founder of Itoen Company in Tokyo, Japan for enlightening me to the academic area.

I am genuinely grateful to my primary sponsor, Conobbys Consulting in Kobe, Japan, and Mr. Seiji Shirane for providing me the great opportunity and continuous encouragement for this challenge.

My sincere thankfulness is expressed to Mr. Stijn Vandermoere for his proofreading, professional suggestions and encouragement.

I would like to thank my family, Lin and my parents for all their support, understanding, and encouragement throughout the years of my study.

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Glossary

2SLS: Two-stage Least squares
ABZ: Aberdeen
AEA: Association of European Airlines
AGP: Malaga
AIC: Akaike Information Critation
Air Do, HD: Hokkaido International Airlines
AKJ: Asahikawa
AMS: Amsterdam
ANA, NH: All Nippon Airways
ANC, EL: Air Nippon
AOC: Airline Operating Certificates
AOJ: Aomori
ASJ: Amamioshima
ASK: Available Seat Kilometres
ATH: Athens
ATI: Air Transport Intelligence
AXT: Akita
BA: British Airways
BC, SKY, Skymark: Skymark Airlines
BCN: Barcelona
BELF: Breakeven Load Factor
BER: Berlin
BFS: Belfast
BRU: Brussels
CAA: Civil Aviation Authority
CFA: Confirmatory Factor Analysis
CFI: Comaprative Fit Index
CGN: Cologne-Bonn
CIA: Central Intelligence Agency
CIS: Commonwealth of Independent States
CPH: Copenhagen
CPI: Consumer Price Index
CR: Critical Values
CR: Council Regulation
CVCA: Customer Value Chain Analysis
DF: Degree of Freedom
DOC: Direct Operating Costs
DUB: Dublin
EC: European Commision
ECAA: European Common Aviation Area
ECAC: European Civil Aviation Conference
EDI: Edinburgh
EFA: Exploratory Factor Analysis
EFTA: European Free Trade Association
EU: the European Union
EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg,
Portugal, Spain, Sweden, The Netherlands, United Kingdom
EUR: euro
FFP: Frequent Flyer Programme
FKJ: Fukui
FKS: Fukushima
FRA: Frankfurt
FY: Financial Year
GAJ: Yamagata
GBP: Pound sterling
GDP: Gross Domestic Product
GLA: Glasgow
GVA: Geneva
HAC: Hachijyo-jima
HAM: Hamburg
HHI: Hirschmann-Herfindahl Index
HIJ: Hiroshima
HIW: Hiroshima-nishi
HKD: Hakodate
HNA: Hanamaki
HND, TYO: Tokyo International Airport (Haneda)
HSG: Saga
HSR: High Speed Rail
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
IMF: the International Monetary Fund

IRCJ: the Industrial Revitalisation Corporation of Japan
ISG: Ishigaki
ITM, OSA: Osaka International Airport
IWJ: Iwami
IZO: Izumo
JAL, JL: Japan Airlines
JD, JAS, JS: Japan Air System
JR: Japan Railways
JTS, NU: Nippon Trans-ocean Airlines
JYE: Japanese yen
KCZ: Kochi
KIJ: Niigata
KIX: Kansai Internatonal Airport
KKJ: New Kitakyushu
km: kilometre
KMI: Miyazaki
KMJ: Kumamoto
KOJ: Kagoshima
KUH: Kushiro
LCC: Low-cost carrier
LGW: London-Gatwick
LHR: London-Heathrow
LIS: Lisbon
LON: London
MAD: Madrid
MAN: Manchester, Liverpool area
MIL: Milano
MILT: Ministry of Infrastructure, Land and transportation in Japan
MME: Durham Tees Valley
MMJ: Matsumoto
MSJ: Misawa
MTOW: Maximum Take Off Weight
MUC: Munich
MYJ: Matsuyama
NCE: Nice
NCL: Newcastle
NFI: Bentler-Bonnet Normed Fit Index
NGO: Chubu International Airport
NGS: Nagasaki
NKM: Nagoya-air field
NRT: Narita International Airport
NTQ: Noto
NYO: Stockholm-Skavsta
OBO: Obihiro
OECD: Organisation for Economic Cooperation & Development
OIM: Oshima
OIT: Oita
OKA: Okinawa, Naha
OKJ: Okayama
ONJ: Odate-Noshiro
ORK: Cork
ORY: Paris-Orly
PFI: the Private Finance Initiative
PPP: Purchasing Power Parity
PPS: Purchasing Power Standard
Prob.: Probability
PRS: Paris area
PSA: Pisa and Florence area
RMSEA: Root-Mean Square Error of Approximation
ROM: Rome
RPK: Revenue Passenger Kilometres
SDJ: Sendai
SEM: Structural Equation Modelling
SHM: Nanki-Shirahama
SHN: Shonai
SNCF: the Societe Nationale des Chemins de Fer francais
SNET, Skynetasia: Skynet Asia Airways
STN: Stansted
STO: Stockholm
STR: Stuttgart
t: tonne
TAK: Takamatsu
TKS: Tokushima
TOY: Toyama
TTJ: Tottori
UBJ: Yamagichi-Ube
UEO: Kumejima
UK: the United Kingdom
UKB: Kobe
UN: United Nations
US: the United States

USA: the United States of America
USD: US dollar
VCE: Venice
VFR: Visiting Friends and Relatives
VIE: Vienna
WKJ: Wakkanai
YGJ: Miho, Yonago
ZRH: Zürich

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Chapter 1: Introduction

***"Competition within the European market is intense and we anticipate further low cost competition on key routes in 2004. We are not afraid of the competition." (Air Lingus former CEO Willie Walsh)*[1]**

1.1 Research background

Airlines are facing strongly competitive environments as a result of the significant changes in the economic regulation of the sector. The airline industry is moving steadily towards full Open Skies in order to achieve the borderless competition that exists in other industries.

The US was the first country in the world to deregulate its domestic market in 1978. The deregulation of the US domestic market and the Canada-US Open Skies agreement significantly eased the regulatory restrictions on the development of airline networks in North America (Oum and Lee, 2002). Within three years of the Airline Deregulation Act nearly all US carriers were experiencing a substantial change in their financial performance (Williams, 1994).

The Computer Reservation System (CRS) had a significant impact on the structure of the deregulated US airlines. Prior to deregulation around two thirds of bookings were made direct with airlines, but by the mid 1980s some 80% were being made via travel agencies (Williams, 1994). As for other significant results of deregulation in the US, hub and spoke networks were operated by large carriers and later point to point operations were developed by new low cost airlines. According to the US DOT, the average fares on the over 750 mile-distance routes decreased by 37% between 1978 and 1990, while over 90% of US domestic passengers were using some type of discounted ticket by the mid-1990s (Yamauchi, 1996).

[1] Airline Business, vol.20, No.5 and col.20, No.3 p.29

The European Union (EU) was the first region in the world to remove all economic restrictions. It was started with the Nouvelles Frontières case in 1986.[2] The process of liberalisation was achieved gradually in three stages and took ten years, from 1987 to 1997 (Chang and Williams, 2002). In 1987, the single European Act was passed by the European Council, which committed EU Member States to the establishment of a common European market by the end of 1992.

The third package of aviation liberalisation was enforced in 1993, completing the single aviation market in Europe. The third package consisted of three regulations. First of all under Council Regulation 2407/92 any community carrier is permitted to operate its air services in the European Union as long as it has an AOC (Air Operator's Certificate). The second part of the 3rd package, Council Regulation 2408/92, deals with access for community air carriers to intra-community air routes, while the third part, Council Regulation 2409/92, is concerned with fares and rates for air services. Overall, the 3rd Package permitted full open access to all EU routes with complete pricing freedom.

Many studies and research papers have analysed the impact of liberalisation of air transport in the EU. One of the most significant outcomes of deregulation in Europe has been the emergence of low cost scheduled airlines. The low cost sector has been expanding rapidly and growing at between 20 and 25 % a year. Barrett (2004) points out the business relationship that exists between airports and low cost carriers. He argues that the combination of low cost carriers and secondary airports has been significant both in terms of LCCs gaining market share and expanding the size of the overall market, as a result of the willingness of passengers to use remote airports, which are typically more distant than the traditional hubs from the major cities.

By contrast, the Northeast Asian markets have been evaluated as being very fragmented because of the inefficient and inconvenient air carrier networks in the region (Oum and Lee, 2002). However, the new waves of low cost carriers that have already affected

[2] The Nouvelles Frontières case at European Court of Justice established that rules governing competition in the Treaty of Rome applied to air transport.

Europe and North America have now started to occur in Asia.[3] Japanese airlines are being forced to cope with the new pressure by reducing costs. Although it has been said by Japanese officials that liberalisation in the domestic market has already been introduced into Japan, the market is not fully liberalised yet. The liberalisation process in Japan was started in 1985 and regarded as having been completed in 2000. It has been implemented in several stages as was the case in the EU. However, there are many incomplete issues concerning liberalisation as a result of the structural problems in Japanese aviation. The impact of new entrants resulting from liberalisation in Japan is therefore significantly different from that of the EU.

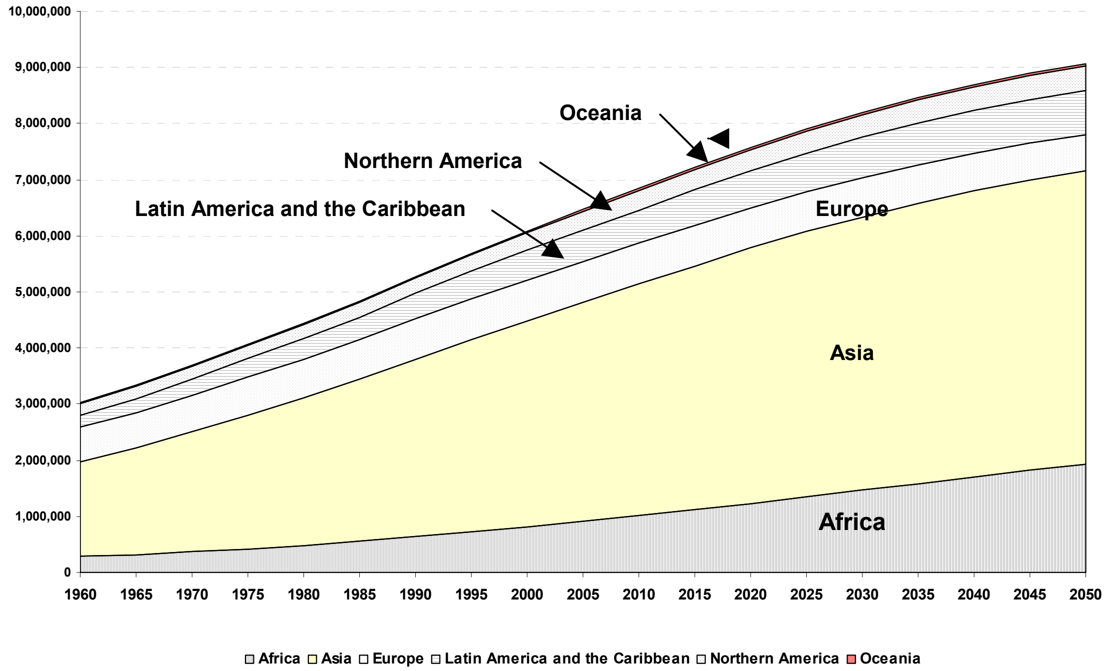
The effect of the air law revision in Japan has been discussed in Japanese literature[4] in comparison with US deregulation. Many authors have appreciated the effects of the domestic market liberalisation in Japan more or less, although they have reservations and have made suggestions for further reforms. However, external evaluations have been severe and more direct. For example, Feldhoff (2002) pointed out the lack of a clear strategy for air transport. The influence of prefecture and municipal actors, including corporations and interest groups, who are guided by regional policy interests, and increasing financial constraints, were all aspects of a system in need of reform. Oum and Lee (2002) highlighted the Japanese protective aviation policy for its carriers against external pressures.

***"Japan protects its carriers at an enormous expense to passengers, most being Japan's own nationals. The Japanese government's overriding concern is in protecting its flag carriers from competition. Unless consumer voices are louder than the carriers', and policy priorities are changed, there will be little reason why the Japanese government will voluntarily agree with the US or any country*"(Oum and Lee, 2002).**

[3] In Australia there is no nationality restriction on setting up a domestic airline. In China there is consolidation around three major carriers. Meanwhile, experiments with liberalization are moving ahead- Hainan Island is now a free market for air services. (Giovanni Bisignani's speech at the International Aviation Club, Washington, DC, 20th April 2004) http:// iata.org/pressroom/speeches (accessed 6h May 2004).
[4] Chujyo.U, 2001. Endo. N., 2001.Shiomi.E,.2001 Transport & Economy (Unyu to Keizai). 2001 Aug, 61(8), 27-34

Given the EU aviation market is one integrated market, it is possible to compare it with the domestic in Japan. Moreover, there are some similarities between Japan and the EU on the timing and process of liberalisation, although they are proceeding differently. Low cost carriers have emerged in both markets. However, their segmentation and impact have been remarkably different. This outcome can be analysed by examining the different attributes of the air transport sectors in Japan and the EU. It is clear that the air transport market in Asia with its current size and future potential and possibilities resulting from liberalisation deserves a huge attention from the world (Figure 1.1).

Figure 1.1: World population growth (thousands)



Source: Author based on the data fromWorld population prospects, The 2004 revision population database, UN (2007)

The LCC is today one of the key drivers for efficiencies in aviation. If allowed to operate in all of the Asia-Pacific region, it would open the door to spectacular growth in the intra-Asian market. **(McDermott, 2004)[5]**

[5] McDermott. P, *AVMARK Aviation Economist*, October 2002. p.7-9

The domestic market in Japan was regarded by the Government as having been deregulated in 2000. However, the effects and results have been different from the experience in other liberalised air transport markets. These different effects and results are analysed, in this thesis focusing on the key characteristics and determinants, which have been studied in academic literature.

Hence, first of all it is essential to know how the effects of air transport deregulation have been investigated and recognised. In order to study the impact of deregulation on air transport markets, an extensive literature search has been undertaken, part of which has been to examine the changes in passenger volumes, fares and other determinants, in the process examining the relationship between each determinant. A number of empirical studies have analysed the effects of liberalisation in various markets involving a variety of determinants (see Table 1.1).

Table 1.1: Selected studies estimating demand and fares involving various determinants

Authors (Published year)	Data period	Areas
Dresner and Tretheway (1992)	1976-1981	North Atlantic routes
Mallebiau and Hansen (1995)	1969-1989	North Atlantic routes
Jorge- Calderon (1997)	1989	Intra European international routes
Nero (1998)	1993	Intra European city-pairs, operated by two carriers
Clougherty et al (2001)	1982-1994	Canadian international routes
Schipper et al (2002)	1988-1992	34 European interstate city-pair routes
Tam et al (2002)	1954-2002	North American network
Bhadra (2002)	1999 -2000	North American regions

Variables in demand equation modelling for the selected studies are shown in Appendix A, while variables in fare equation modelling for the selected studies are shown in Appendix B.

In the literature relating to the US market, Dresner and Tretheway (1992), using data from 1976 to 1982, found that liberalised US bilateral agreements lowered discount fares by 35% in the North Atlantic markets. Dresner and Oum (1998) showed that Canadian liberalisation increased international passenger traffic over the period 1975 to 1994. The available literature supports the view that US liberalisation policy led to increasing traffic, lower prices and other consumer benefits. These outcomes have been recognised as the key effects of deregulation. Similar results are demonstrated in the case of the European market.

In respect of the impact on airline fares, Dresner and Tretheway (1992) and Nero (1998) used two-stage least squares (2SLS) techniques to estimate fares. Nero (1998) used a model which estimated passenger volume on routes using the following variables: average population of the two end points, volume of trade, service frequency, and the ratio of train to flight journey times. This study found that European airlines in the late 1980s discriminated price according to the journey origin, with lower fares persisting on routes which experienced liberal bilateral agreements.

Jorge-Calderon (1997) showed that demand tends to be inelastic with respect to the unrestricted economy fare and that most discounted fares were found to generate traffic on shorter distance routes in the intra-European market in 1989. The estimated fare and frequency equations analysis in this study also showed that standard economy fares are lower and departure frequencies higher on fully liberalised routes than on routes without such liberalisation.

Clougherty et al (2001) assessed the impact of Canada’s partial liberalisation policy on air traffic volumes in the international market using the results of modelling of air traffic determinants to formulate regression equations and found international passenger traffic levels increased between 1982 and 1994. However, they were unable to measure the effect on airfares or consumer welfare because of the lack of average air fare data.

Schipper et al (2002) measured the impact of liberalisation on European interstate routes in terms of changes in consumer welfare, which was calculated using a demand equation with data from 1988 to 1992. Demand was assumed to depend on exogenous variables, including income and the number of potential passengers on the one hand, and an endogenous ticket fare variable on the other. The estimated fare and frequency equation[6] showed standard economy fares were lower and frequencies were higher on fully liberalised routes than on routes without such liberalisation.

Demand is also influenced by macro-economic determinants. Tam et al (2002) identified key relationships between the economy and the air transportation system by focusing on the close relationship between airlines and the supply/demand of air transportation in the North Atlantic network over 48 years from 1954 to 2002. This study indicated that airlines control prices, networks and schedules, which in turn have a major impact on the demand for air transportation services, and there was a close correlation between annual economic growth and air travel after deregulation. Bhadra (2002), using data for 1999 and 2000, identified the determinants of air transport demand at the local level in the North American regions to estimate demand on routes, using variables including local economic activities, demographics and industry characteristics.

It is clear that the effects of air transport deregulation have been investigated and analysed using several key determinants. The term “Competition” represents one of the prominent characteristics of deregulation and liberalisation. Clougherty et al (2001) produced a fare equation using the variable “Market Competition”, where market competition reflects the competitive forces in a market, in order to estimate traffic volume. The number of competing airlines in a market is used as a variable to determine the degree of competition. Williams (2002) revealed the effects of deregulation on a

[6] In this study, the fare and frequency variables in the passenger demand equation are treated as endogenous variables.

market by measuring market concentration using the Hirschman Herfindal Index (HHI)[7] demonstrating the competitive changes on routes. Changes in the level of competition resulting from liberalisation can be demonstrated by various methods. “Competition” is not only the result of deregulation but is also the driving force to innovate the market and is the objective of deregulation itself. Hansjochen (2001) explained that the objective of liberalisation is to maintain sustainable competition and the competition concept is useful as the means to be achieved with an increasing influence of market forces and a decreasing influence of regulatory interventions. Hence, the effects of air transport deregulation have been investigated and analysed using several demand determinants. These determinants and the relationships between them demonstrate clearly the characteristics and effects of deregulation.

Slot allocation policy is also one of the important factors and issues for deregulation and liberalisation. Slot utilisation is one of the comprehensive measurements used to assess the efficient use of an airport. Slots are the most important assets for the public and airlines alike (Madas, et al, 2006). Traditionally, the allocation of slots is based on the principle of histric precedence and is organised through airline acheduling committees established at designated airports world wide.

In the US, slot allocation policy was changed from 1985 as part of the deregulation process. The US Department of Transportation terminated slot allocation policy and introduced a “Buy and sell” method for allocating limited slots. Starkie (1998) analysed the problem of allocating landing slots at congested airports from an economic perspective and concluded that a secondary market in slots would encourage a more efficient use of these scarce resources. In his study, slot utilisation was measured in three ways: (1) the average rate at which slots were used; (2) whether leased slots were used more intensively than owned or operated slots; and (3) the average daily seat capacity per slot.

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[7] The Hirschman Herfindal Index (HHI): A commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers. The HHI value can range from close to zero to 10,000. The HHI is expressed as: HHI = s1^2 + s2^2 + s3^2 + ... + si^2 (where si is the market share of the ith firm).

Abeyratne (2000) studied the management of airport congestion from the point of view of slot allocation. He mentioned that most of the busiest airports in the world are denied monetary trading or similar slot allocation mechanisms. Moreover, he explained the situation in Europe where they have established scheduling and coordinating organisations or Governmental administrators have been established in order to follow the IATA guidelines or the EU Regulation 95/93. The European Union introduced Regulation 95/93 on common rules for the allocation of slots at community airports on 18 January 1993 (European Economic Community, 1993). The aim of this Regulation was to ensure that where airport capacity is scarce, the available capacity is used efficiently and distributed in a fair, non-discriminatory and transparent way (Commission of the European Communities, 2001). In the Article 6 of Council Regulation (EEC) No. 95/93 of January 1993, airport capacity is descrived in Appendix C (1).

This regulation incorporated the grandfather right principle and allowed slots to be freely exchanged or transferred in a strict and transparent manner without monetary exchanges under the coordination of a slot coordinator (Abeyratne, 2000). This is mentioned in detail in Council Regulation (EEC) No. 95/93 of January 1993 Article 8 (Appendix C [2]). Furthermore, the slot allocastion for new entrants is regulated in Article 8 and “New entrant” is defined as airlines which has less than four slots per day at the designated airport unless they don’t have more than 3% of the total slots per day at a particular airport or more than 2% of the total slots per day in an airport system in Article 2 (Appendix C [3]).

The European Commission amended Regulation 95/93 in 2001 with the objective of ensuring scarce capacity at Europe’s congested airports is managed efficiently but without risking radical changes to the administrative system of slot allocation built around grandfather rights. Under this regulation, airlines can no longer consider slots as their property, but as a permission to use airport facilities. In 2003, the European Commission reformed slot allocation to make it easier for new entrants to access the market and make better use of airport capacities.

In an Australian context, Forsyth (1997) examined several issues about the price regulation of privately owned airports. He argued that efficient handling of congestion can be reconciled with price caps if the regulator determines the appropriate congestion and capacity trade off, and supervises slot allocation.

1.2 Research aim and objectives

The domestic market in Japan was deregulated in 2000. However, the effects and results have been different from the experience of other liberalised air transport markets. Explaining the different effects and results is the key aim of this research. The study identifies the structure of deregulated air transport markets during the process of air transport liberalisation using qualitative and quantitative methods. The characteristics and effects of liberalisation of air transport in Japan's domestic market serving Haneda airport are analysed and compared with those of intra-European routes. Using the results of these analyses, this study seeks to address important issues about the process of deregulation in order to contribute to future policy making. In addition, this research attempts to identify the best direction for policy with regard to air transport in Japan to enable a common aviation market in Asia to be achieved.

The specific objectives of this research are:

- To examine in which ways air transport liberalisation in Japan has been different from the experience in other regions of the world.
- To analyse the characteristics and effects of air transport liberalisation in the Tokyo domestic market in comparison with the effects of liberalisation in the EU.
- To identify the structure of the deregulated air transport market during the process of air transport liberalisation in Japan using qualitative and quantitative methods.
- To address important issues about the process of deregulation in Japan and identify constraints for further liberalisation.
- To identify the best direction for policy with regard to air transport in Japan to enable a common aviation market in Asia to be achieved

1.3 Research questions

With respect to fulfilling the main objectives of this research, the study focuses on the Tokyo domestic market for analysis.

There are two international airports that serve the Tokyo Metropolitan city: (1) Narita International Airport (55kms away from the centre of Tokyo) which is recognised as one of the international hub airports in Japan, which handled more than 31 million passengers including 1 million domestic passengers connecting to eight Japanese airports in 2006, (2) Haneda airport (Tokyo International Airport) which was opened in 1931 has been developed as the main interntional and domestic airport in the centre of Tokyo. Since Narita airport opened in 1988, most of international flight operations were moved to Narita airport except Air China and a few general aviation flights. Haneda airport has been extended as a main domestic airport in Japan, which handled 64 million passengers including 1 million international passengers in 2007. Therefore, in order to analyse the domestic market in Japan, the Tokyo domestic market serving Haneda airport is analysed.

The Tokyo routes are used to estimate the model used in this research for the following two reasons: firstly, the Tokyo routes are Japan's major domestic markets, their scale is extremely large and they have maintained their share of the domestic market in Japan, and secondly, the effects of the slot allocation system at Haneda airport (Haneda) have had a profound impact on the air transport market after deregulation. As the slot allocation system at Haneda airport has been implemented during the liberalisation process, the effects of this system on the market will be demonstrated and analysed. The results reveal the determinants which have contributed to the effects of liberalisation. Using the results of these empirical analyses, the factors influencing the Tokyo market are examined.

In line with the process of liberalisation in the air transport market in Japan, the new slot allocation policy has been in place since 1997 at Haneda airport in order to promote competition and the formation of a diverse air transport network for the improvement of consumers' convenience and interest (both passengers and cargo). New entrants have emerged in Japan and the competitive environment has been discussed more and more under the pressure of globalisation with deregulation. Arguments are raised here whether the aims of the slot allocation policy have been achieved and how they have been implemented and affected the domestic air transport market as a result of liberalisation.

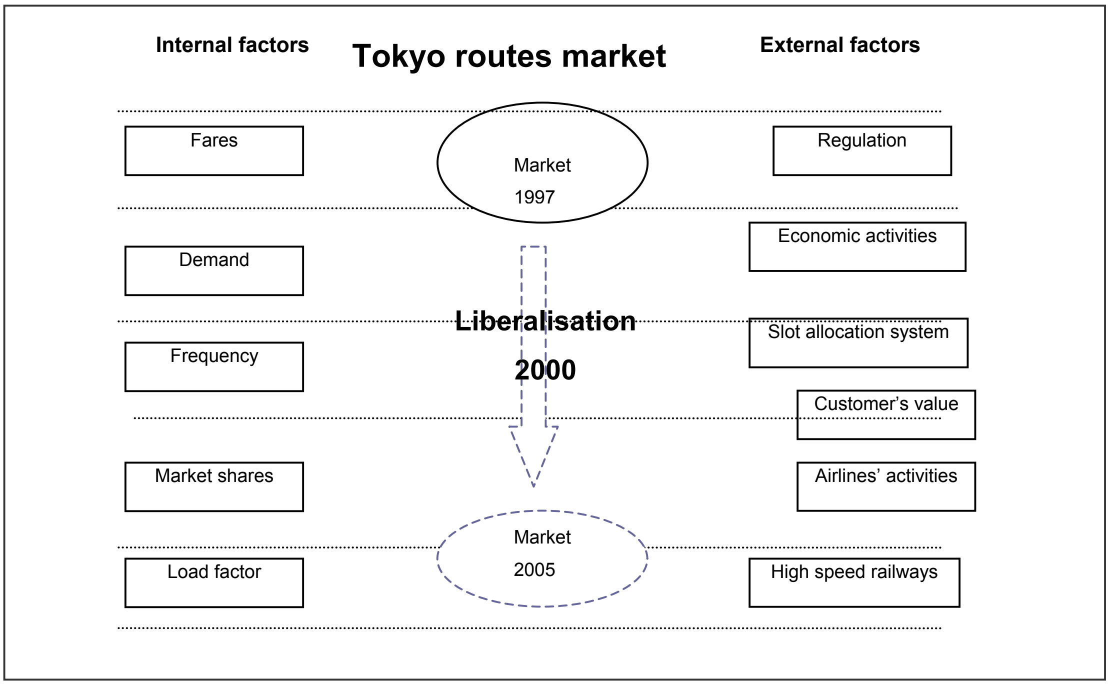
In order to fulfill the main objectives of this research, the following research questions are posed and answered in this study.

1. How has the air transport domestic market in Japan been developed and how has deregulation policy been decided and implemented?
2. What are the features and characteristics of the Tokyo market?
3. How significant is the competition between air transport and high speed railways serving Haneda?
4. What are the key determinants of this competition and are they representative of the effects of liberalisation in the rest of the domestic market in Japan?
5. How has the slot allocation policy at Haneda airport been decided and provided historically, especially pre and post liberalisation?
6. How has the market been affected by the slot allocation policy and system?
7. How have airlines reacted to the slot allocation system?
8. How has the Tokyo routes market been transformed as a result of deregulation over the past decade?
9. What is the difference in the effects of liberalisation between the Tokyo routes market and the intra-European market?
10. What are the reasons for the different experience in Japan?

The following schematic provides a framework in order to discuss the aforementioned questions (see Figure 1.1).

As a result of the liberalisation of the domestic air transport market in Japan from 1997 to 2005, along with the slot allocation system at Haneda Airport, the Tokyo routes market has been transformed and affected by several key factors. Moreover, the result of the effects demonstrates and explains the contrasts from other deregulated markets.

Figure 1.2: Relationship between influencing factors in the analysis of the Tokyo routes market



1.4 Methodology and research structure

In order to answer the aforementioned questions and pursue the main objectives of this study, the following methodology has been adopted.

1. **Analysis of the development of the domestic air transport market in Japan**

   In order to understand the historical background of the domestic air transport market in Japan and provide a comprehensive overview of aviation development in Japan, an exploratory study is undertaken. This focuses mainly on the domestic market and the evolution of Japanese government policy after World War II. The key elements of this exploratory study are as follows:

   a. Historical review of aviation in Japan
   b. Historical review of airlines in Japan

c. Overview of Civil Aviation Bureau of Japan (JCAB) policy
d. Influence of the airport system in Japan

2. **Analysis of the impact of liberalisation on the domestic air transport market serving Tokyo**

The Tokyo routes are analysed using qualitative and quantitative methods in order to identify the key characteristics and features of the domestic air transport market in Japan. To conduct this analysis, the market has been segmented into six groups according to the level of demand. As the slot allocation system at Haneda airport has been implemented during the deregulation process, the effects of this on the market are demonstrated. The results reveal the determinants which have contributed to the effects of liberalisation. Econometric analyses and multivariate statistical methods are used to discover the factors which influence or control the effects of deregulation on the market. The main determinants (supply, demand, fares, service frequency, demography, the existence of new entrants, economic activities, load factor, etc), identified in previous literature are used to demonstrate the effects of deregulation and liberalisation, with each market category being analysed in detail each year from 2000 to 2005. Fares on all the routes are analysed to investigate how they have changed during the process of deregulation. Not only how each determinant affected the market but also its relationship will be analysed in order to demonstrate the structure of the Tokyo domestic market in Japan. Moreover, the results of these empirical analyses are examined using Structural Equation Modelling. The relationships between factors, which were revealed as the key determinants of the structure of the deregulated air transport market in Japan, are thus analysed and demonstrated. Both inductive and deductive approaches are undertaken. The various elements of this analysis are as follows:

a. The attributes of the Tokyo domestic market in Japan are investigated using several indices, such as the number of passengers carried, the number of seats supplied, the number of flights, aircraft type, average load factors, and HHI (from 2000 to 2004).

b. The policy and process of the slot allocation system at Haneda airport are investigated focusing on the policy making procedures and implementation process.
c. The relationship and differentiation of services between the high speed railway and airlines are analysed, as are the effects on the market as a result of the competition between them.
d. The effects of the slot allocation system on individual routes and market categories of the Tokyo routes as a result of liberalisation are analysed in detail using several factors, including demand, supply, frequencies, fares, load factors, and HHI, using data from 1997 to 2005 in line with the process of liberalisation and the slot allocation system in 1997, 2000, 2001 and 2003. The focus is on investigating how these factors have been transformed and have affected the market.
e. The relationship between airline strategies and the characteristics of destinations (local economic activity, demographics, and industry characteristics) and the impact of deregulation on each route category are investigated.

3. Comparative analysis of the effects of liberalisation in the Tokyo domestic markets and selected intra-EU routes

In order to conduct comparative analyses of the effects of liberalisation in the Tokyo domestic markets and the intra-EU markets, the same logic and methodology is adopted. Several intra-EU and domestic routes from the UK are selected and analysed using data from 1997 to 2005. Four country pairs are mainly considered: UK-France, UK-Germany, UK-Spain and UK-Italy for the following two reasons: (1) the routes serving the UK are considered as the most mature LCC markets, (2) each pair of countries combined had much the same size of population and GDP as that of Japan in 2003.[8]

The selected factors for analysis are as follows: the number of passengers carried, the number of seats supplied, frequencies, average capacity per departure, average load factors, the number of low cost carriers, the number of carriers, market share, the number of airports, economic activities (GDP, local regional GDP per capita), and demographic factors (population, working population). Fares are excluded in this comparative analysis because of the lack of availability of actual fare data in the intra-EU market. The results of the analysis are compared with the outcomes of the Tokyo routes analysis in order to demonstrate the characteristics of the intra-EU market after liberalisation and the different experiences of the Tokyo routes market. The period from 1997 to 2005 has been chosen for this comparative analysis in order to have variation in the liberalisation status between Japan and selected EU countries, enabling the situation between the partly deregulated and the fully liberalised market to be contrasted. The main elements of this analysis are as follows:

a. The characteristics and features of the selected routes in the intra-EU market are examined using UK CAA data from 1997 to 2005. The market is categorised based on UK CAA data in 2000 adopting the same scale used for the Tokyo routes market analysis.
b. The analysis investigates and compares with the results of the Tokyo routes analysis focusing on the examination of how the market has been changed and affected by the impact of liberalisation using several factors including the number of passengers carried, the number of seats supplied, frequencies, average capacity per departure, average load factors, the number of low cost carriers, the number of carriers, market share, the number of airports, economic activities (GDP, local regional GDP per

[8] GDP (US$, Purchasing Power Parity Method in 2002) and Population (2003) Japan (3.55 trillion, 127 million), France (1.54 trillion, 60 million), UK (1.52 trillion, 60 million), Germany (2.2 trillion, 83 million), Spain (1.07 trillion, 40 million) and Italy (1.4 trillion, 58 million) Source: CIA World Fact Book in 2000 and UN the 2002 revision population database.

capita), and demographic factors (population, working population) in order to discover the different experiences between them on the individual routes and market categories.

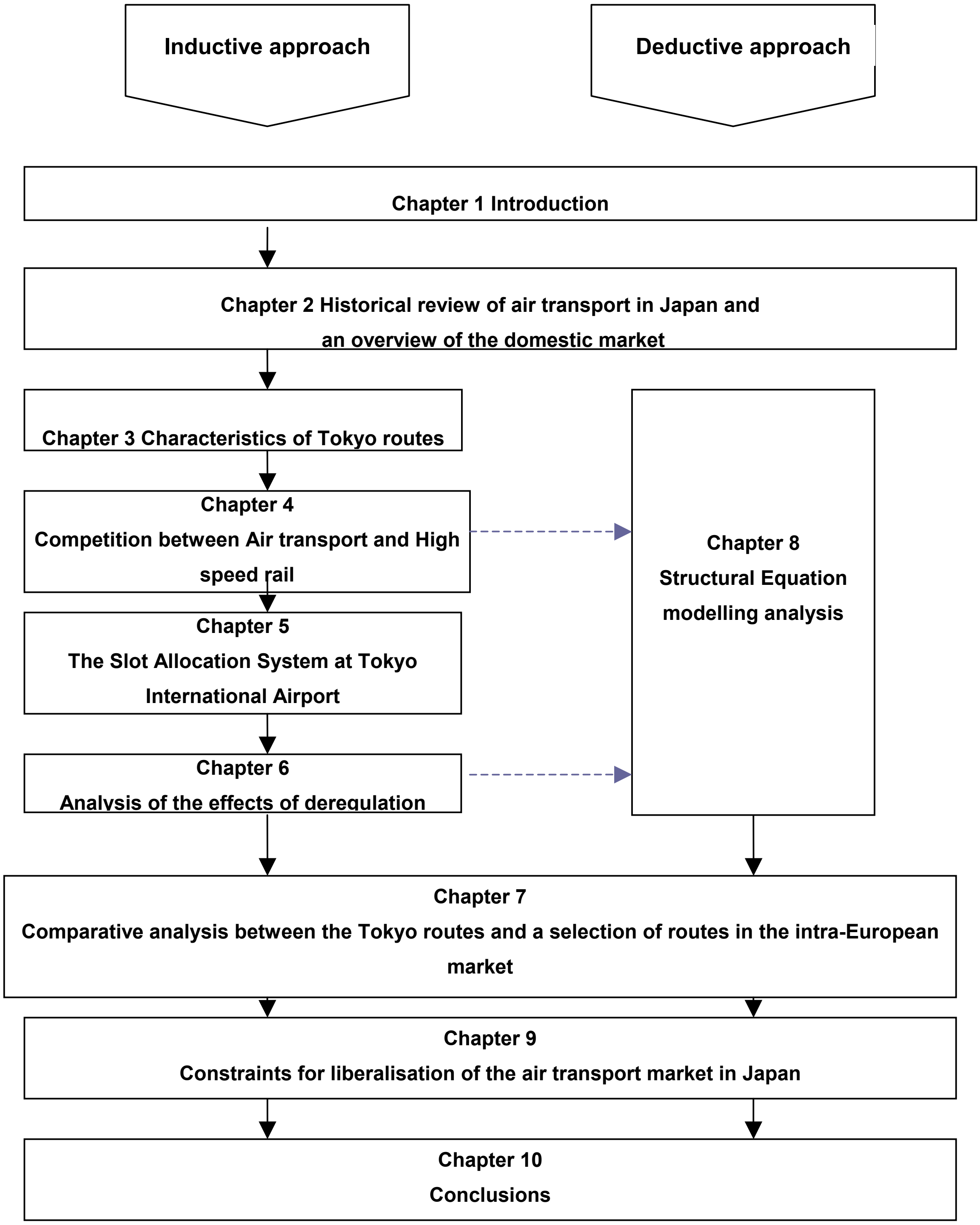
c. The mechanism of LCCs success in the intra-EU market is investigated and analysed by focusing on their products in comparison with Japanese airlines in order to find the key influencing determinants that differentiate the effects on each market and to explain the reasons for the different experiences by identifying the constraints for liberalisation of the domestic air transport market in Japan.

1.5 Research structure and thesis layout

Given the aforementioned objectives and methodology of this research, the thesis is structured as is shown in Figure 1.3. The layout of the thesis in terms of individual chapters follows.

1.5.1 Research structure

Figure 1.3: Research structure



1.5.2 Thesis layout

1. **Introduction**

Chapter 1 provides the research background and literature review relating to the subject of this dissertation. The aim and objectives of this study are stated, with the key research questions that are addressed. The research methodology adopted in order to achieve the main objectives is then explained. In addition, the research structure and thesis layout is given.

2. **An historical review of aviation and overview of the domestic market in Japan**

Chapter 2 explores the historical background and provides a comprehensive understanding of the domestic air transport market in Japan giving details of the regulatory reforms in the liberalisation process and policies adopted in Japan and the EU.

3. **The Tokyo routes market**

Chapter 3 investigates the Tokyo routes market in order to identify the characteristics and features of the major domestic air transport market in Japan.

4. **Competition between air transport and high speed rail**

Chapter 4 aims to identify the key determinants of competition between air transport and high speed railways in the Tokyo routes market, where networks of both air transport and high speed railways have expanded.

5. **The Slot allocation system at Tokyo International airport**

Chapter 5 investigates the policy and process of the slot allocation system at Haneda airport.

6. **Analysis of the impacts of deregulation and effects of the slot allocation system on the Tokyo routes market**

Chapter 6 investigates the effects of deregulation and the slot allocation policy on the Tokyo routes market.

7. Comparative analysis between the Tokyo routes and a selection of routes in the intra-European markets

In chapter 7, a comparative analysis is conducted between the Tokyo domestic routes and the intra-EU and domestic routes serving the UK in order to identify the different experiences between them as a result of liberalisation and to explain the reason for these differences.

8. Structural Equation Modelling analysis of the Tokyo routes Market

Chapter 8 seeks to model the results of chapters 4 and 6, using Structural Equation Modelling (SEM) in order to assess the results and validate them statistically. It provides an evaluation of the importance of each determinant in the model and tests the overall fit of the model to the data.

9. Constraints for liberalisation of the air transport market in Japan

Chapter 9 highlights the constraints for liberalisation of the air transport market in Japan based on the results of the comparative analysis of chapter 7, which enables the case of partly liberalised and fully liberalised markets to be contrasted.

10. Conclusions

Chapter 10 provides a summary of the thesis conclusions and the recommendations for future policy, in addition to formulating recommendations for further academic research. The limitations of this research are also made clear.

Chapter 2: Historical review of air transport in Japan and an overview of the domestic market

The main aim of this chapter is to provide a comprehensive understanding of the domestic transport market in Japan and the evolution of Japanese government policy in order to discover how the domestic air transport market has been developed and deregulation policy has been put into practice by means of an exploratory study mainly based on available literature and official Government documents such as advisory circulars.

2.1 The incunabula

Civil Aviation in Japan started in 1951 after World War II, when the former Japan Airlines started its first commercial flight service on Martin 202 Mokusei aircraft by entrusting Northwest Airlines. The General Headquarters of the occupation army of the United States (GHQ) allowed Japan to operate a domestic air service by an operator with Japanese capital in July 1952. The Air law in Japan was promulgated and Haneda airfield was returned to Japan by the occupation army and renamed Tokyo International Airport. The former Japan Airlines started its domestic operation by themselves on a DC-4 as the first private airline in Japan, when the US-Japan bilateral agreement was signed in August, 1952.

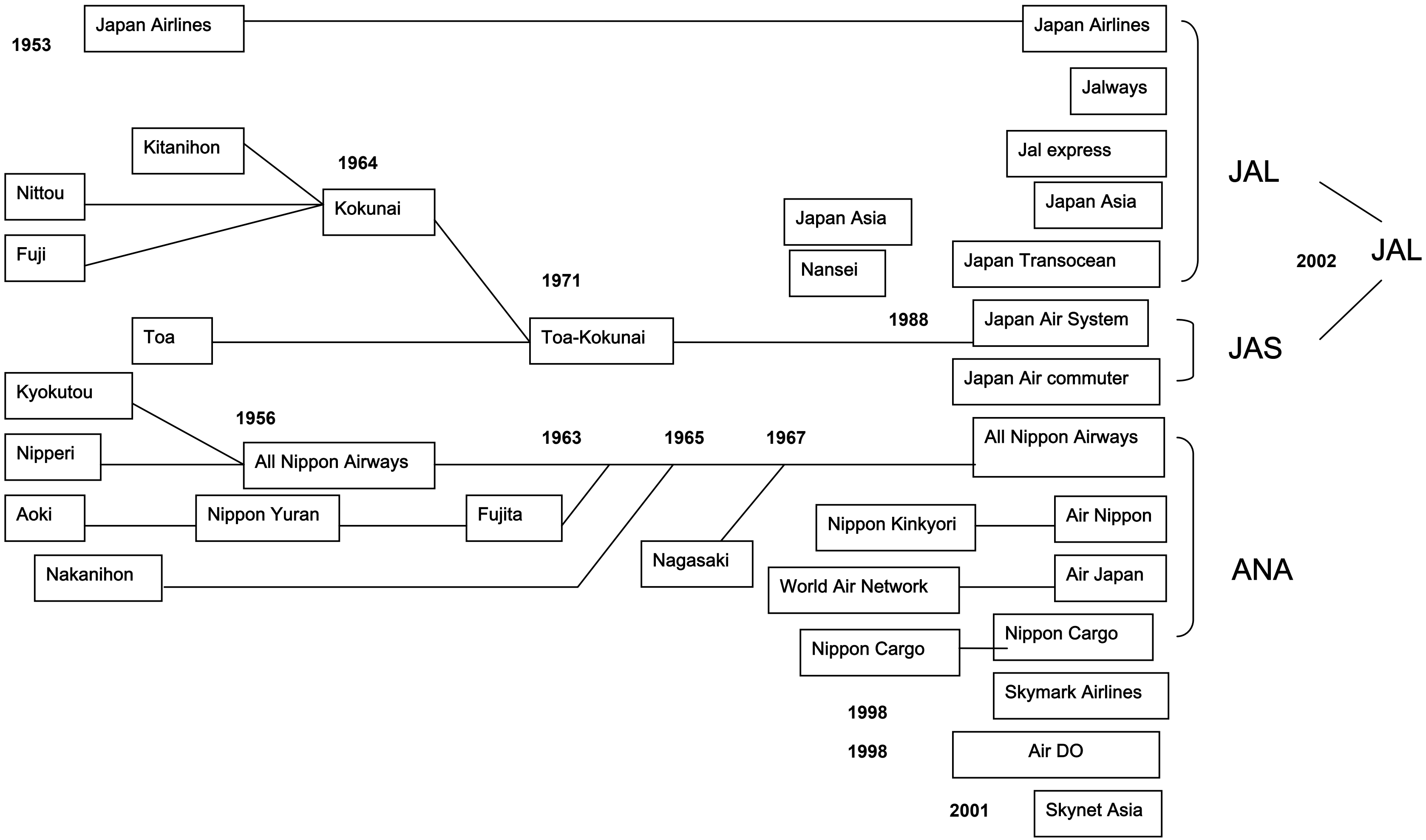
Later, the Government decided to restructure the former Japan Airlines as a half-government-owned public corporation. The purpose of this reform was to establish the airline company as a national flag carrier (Yamauchi and Ito, 1996). “The law of Japan Airlines” was issued in August, 1953 and Japan Airlines was officially established as a flag carrier and participated in the International Civil Aviation Organisation (ICAO) in October, 1953. They started the first international operation from Japan to San Francisco in 1954.

In the initial phases of civil aviation in Japan, approximately nine airlines were founded around 1953. After these small private airlines engaged in significant merger activities, the present air transport structure was established at the beginning of 1970s (see Figure 2.1). In 1956, two private carriers, which were "Kyokutou Kouku (Kyokutou Airline) and Nipperi Kouku (Nipperi Airline), were merged to form "All Nippon Airways", which was the first fully private carrier after the law of Japan Airlines was issued to set up that company as a flag carrier. Later, All Nippon Airways merged with several companies and became the second largest airline in Japan.[9] Three carriers, which were Nitou, Fuji and Kitanihon, were merged into Kokunai Kouku (Japan Domestic Airline) in 1964 and later this was merged with Toa Kouku (Toa Airways) to form Toa Domestic Airlines in 1971. It was renamed later as Japan Air System in 1988.[10]

[9] ANA merged with Fujita Airlines in1963 and the scheduled operation of Nakanihon in 1965 and Nagasaki Airlines in 1967.

[10] Japan Airlines and Japan Air System were merged in 2002.

Figure 2.1: The history of airlines in Japan (1953 -2002)



Source: Ministry of Infrastructure, Land and Transport (2005)

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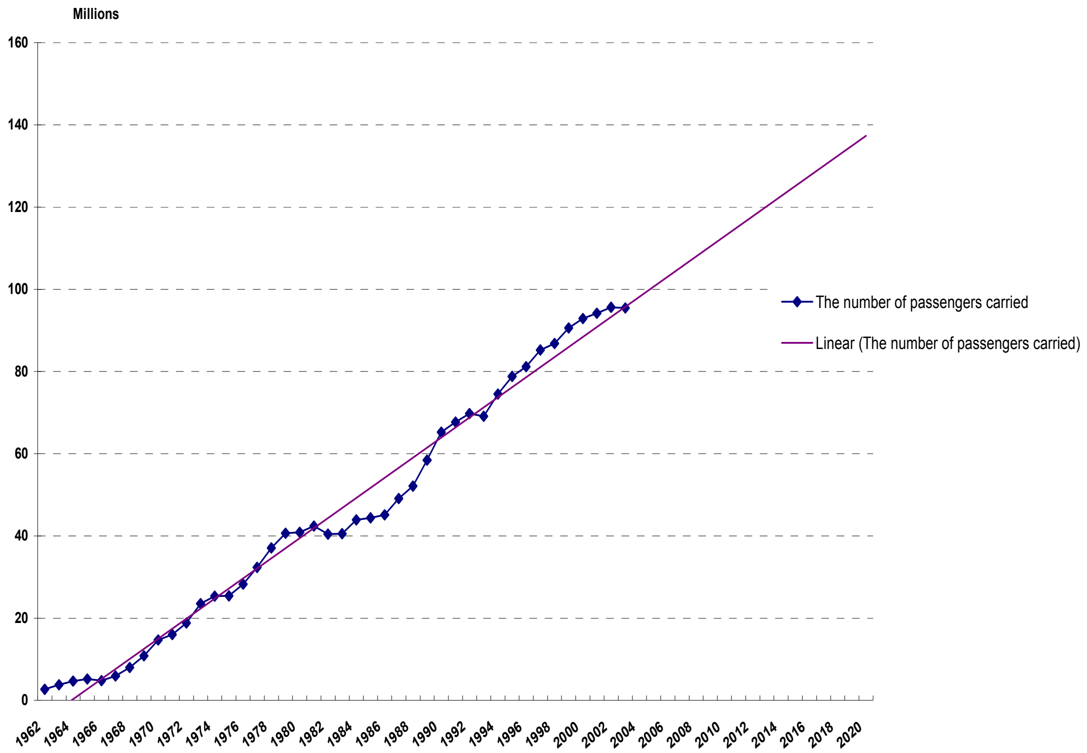
2.2 Regulation of air transport in Japan

2.2.1 The 45 and 47 aviation system

In line with the rapidly growing economy in Japan in the late 1960s, demand for air services increased significantly (see Figure 2.2). At the same time, many aircraft accidents occurred in this period (Table 2.1). As a result, the Government issued policy directives for future air transport and issued two laws, which were “the Cabinet Meeting resolution concerning Airline Operations” in November, 1970 and “the Notice of the Ministry of Transport” in July 1972.

Figure 2.2: The number of passengers carried in the Japanese domestic market



Source: Author based on data from Ministry of Infrastructure, land and Transport, Aviation Statistics (1962-2005)

Table 2.1 : Main airline accidents in Japan during the 1960s and 1970s

Date Airline/ Aircraft type	Flight Routes Accident place	Casualties
04, Feb, 1966 ANA / B727	From Sapporo to Tokyo Tokyo bay	Fatalities 133 (Crew: 7 Passengers: 126)
04, Mar, 1966 CPA / DC-8	From Hong Kong to Vancouver via Tokyo Haneda Airport	Fatalities 64 (Crew: 10 Passengers: 54) Serious injury (Passengers: 8)
05, Mar, 1966 BOAC / B707	From San Francisco to Hong Kong via Honolulu and Tokyo Mt. Fuji	Fatalities 124 (Crew: 11 Passengers: 113)
13, Nov, 1966 ANA / YS11	From Osaka to Matsuyama Iyo nada(the sea area around Matsuyama airport)	Fatalities 50 (Crew: 5 Passengers: 45)
20, Oct, 1969 ANA / YS11	From Kagoshima to Miyazaki Miyazaki Airport	Seriously injury 23 (Crew : 3 Passengers:20) Injury 19 (Crew: 1 Passengers: 18)
03, July, 1971 TDA / YS 11	From Okadama to Hakodate Mt. Yokozu	Fatalities 68 (Crew: 4 Passengers: 64)
30, July, 1971 ANA and Defence force/ B727, F86	From Sapporo to Tokyo Air field around Shizukuishi	Fatalities 162 (Crew: 7 Passengers: 155)

Source: Ministry of Infrastructure, Land and Transport, Aviation Statistics (2005)

The fundamental principle of this policy was aimed at achieving: (1) the promotion of consumers' convenience and (2) the assurance of safety, while coping with the rapid development of air transportation in the early 1970s.

Furthermore, in this Cabinet Meeting Resolution, the Government policy demonstrated the directions not only for the field of airline business activity but also airline management itself regarding mergers, finance and engineering matters.

In Article 1 of the Cabinet Meeting Resolution, (1) the large sized jet airplane's operation (2) the establishment of Toa Domestic Airlines (TDA) and (3) the double designation on the high demand local routes[11], were promoted in the domestic market. Regarding the international routes, (1) the monopoly operation by Japan Airlines (JAL) on the scheduled international routes, (2) the international charter flights by JAL and All Nippon Airways (ANA), (3) the prospect of international cargo airlines and handling were stated in Article 2 (see Appendix C [4]).

In **"The Cabinet Meeting Resolution of 1970",** the structural change from an air transport industry with a two companies (JAL and ANA) structure to a three companies structure (JAL, ANA and TDA) in Japan was approved. The main policy of **"the Cabinet Meeting Resolution of 1970"** was embodied in the following "**Cabinet Notification of 1972".** It defined the business fields of the three airlines in order to eliminate excessive competition among them and promote co-existence and their co-prosperity, and control the market share of supply (see Appendix C [5).

This structural policy for the aviation industry in Japan was established in 1970 and 1972 by the so-called "Aviation Constitution ", which is widely referred to as the "45 and 47 system" (youngo-yon nana taisei). Kawaguchi (2000) explained the background of this policy establishment as follows. All Nippon Airways (ANA) had been desiring to take part in the international scheduled market in Asia since the 1950s, especially to Mainland China, because the then ANA CEO Mr. Kiheita Okazaki had a strong leadership in the China-Japan Friendship Association. During the 1950s, JAL's market share in the Japanese international market stood at 40%, with non-Japanese accounting for the rest. ANA claimed that this market share imbalance was caused by the lack of Japanese airline's supply in the market and ANA's market entry should increase to a combined Japanese market share of 50%. However, JAL was strongly against ANA's claim, arguing that ANA would not be able to compete against non-Japanese airlines in the international market because of their inexperience and inability. It would cause market cannibalisation between JAL and ANA because ANA depended only on the Japanese passenger market (Kawaguchi, 2000). As a result, ANA was only allowed to

[11] "The domestic trunk routes" are defined as all domestic flights from Sapporo, Tokyo, Osaka, Fukuoka and Okinawa (Naha) and "the domestic local routes" as all routes except the trunk routes.

operate on short-haul international charter flights as JAL's claim was supported by the Government.

As for the domestic market allocation by the Government, TDA had sought high-demand trunk routes (routes between Tokyo, Sapporo, Osaka, Fukuoka, and Okinawa) because TDA only operated non-profitable local routes. On the other hand, the two incumbent airlines on trunk routes, JAL and ANA were strongly against TDA's entrance on the trunk routes. Again, the two incumbent airlines' opinions were supported by the Government and the fundamental policy of the 45 and 47 system was established.

Table 2.2: The 45 and 47 system; Market shared out by the Government

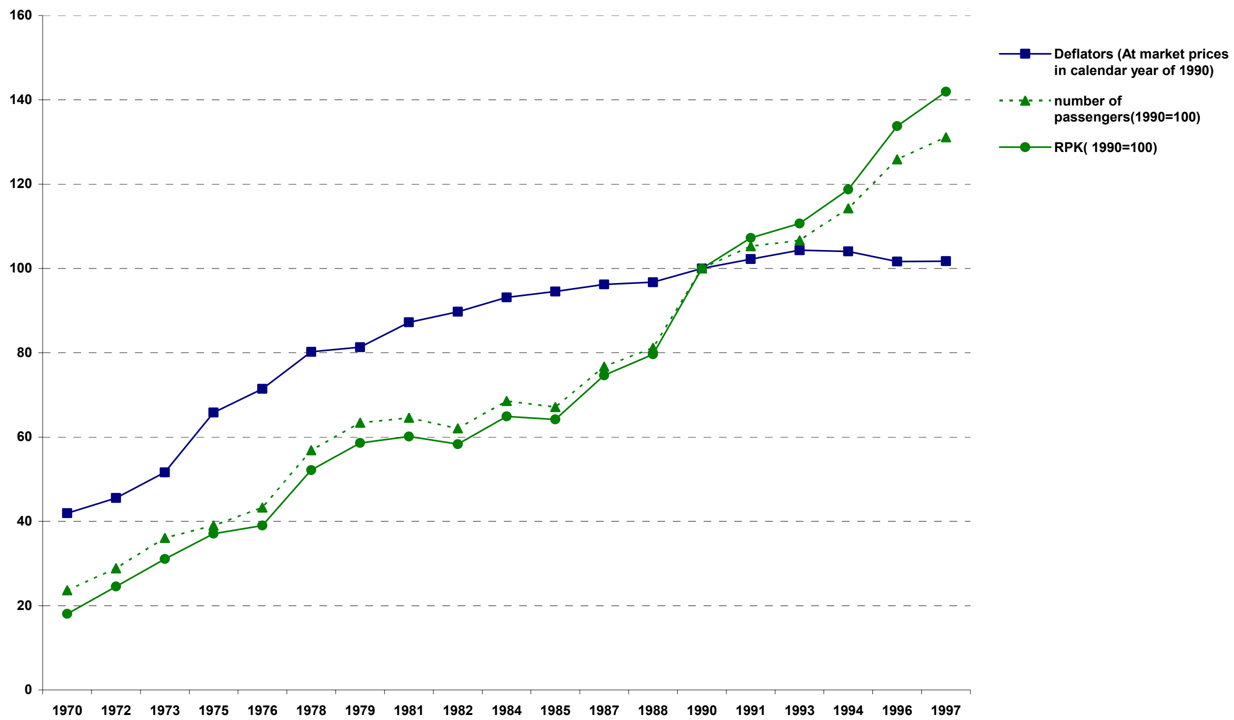
Route type	Airlines
International scheduled routes	Japan Airlines
International charter routes	Japan Airlines, All Nippon airways
Domestic trunk routes	Japan Airlines All Nippon Airways
Domestic local routes	All Nippon Airways Toa Domestic Airlines

Under this 45/47 system, the market was divided by the Government, with all scheduled international routes and domestic trunk routes given to Japan Airlines, domestic trunk and local routes to All Nippon Airways, and local routes to Toa Domestic Airlines (later renamed Japan Air System). This policy was adopted in order to enable cross-subsidisation to occur in the Japanese market and to maintain the growth and stability of Japanese airlines in balance with economic growth in Japan. The present air transport structure in Japan has been determined by this constitution (Shiomi, 2001).

2.2.2 The start of the promotion of competition

In the 45/47 system, excess competition was avoided in order to promote co-existence and co-prosperity of airlines and the market was controlled by the Government. Ten years after the introduction of the 45/47 system, the air transport market in Japan had grown vastly as the Japanese economy prospered (see Figure 2.3). Under pressure of liberalisation in the US and Europe, the liberalisation process in Japan was started in 1985 and is regarded as having been completed in 2000. It was implemented in several stages as in the EU. In 1985, the 45/47 system was repealed and government policy was changed to allow greater market access. This new policy allowed airlines to enter routes according to the size of the market, which was defined by the total number of passengers carried the previous year. These double and triple designation rules were enforced in 1986 as **"the transport policy meeting report of June 1986".**

Figure 2.3: GDP deflator, the number of passengers and RPK in the Japanese domestic market (1990= 100)



Source: Author based on data from Department of National Accounts, Economic and Social Research Institute, Cabinet Office (2005) and Ministry of Infrastructure and transport, Aviation Statistics (1970 – 1998)

In Article 4 of **"the discussion of the management structure of the airline industry in the future"** (The transport policy meeting report of June, 1986), the competition promotion policy in the domestic market was presented as follows:

(1) The promotion of double and triple designations routes according to the level of demand.
(2) The appropriate competition considering a company's scale
(3) The business planning by airlines according to this policy
(4) The securing of non-profitable routes which are regarded as an important air transport service to local citizens.

See Appendix C (6)

Under the 45 and 47 system rules, all trunk routes (all the routes from Tokyo, Sapporo, Osaka, Fukuoka and Okinawa) and several local routes from Tokyo to Kagoshima, Nagasaki, Oita and Hakodate were operated by JAL and ANA as double designation routes. The competition promotion policy was enforced in 1986; it allowed double designation to the market on routes with annual passenger demand of more than 300,000 and triple designation on routes with annual passenger demand of more than 600,000, for all routes connecting Tokyo, Sapporo, Nagoya, Osaka, Fukuoka, Kagoshima and Okinawa. On other routes, it allocated double designation to markets with annual passenger demand of more than 700,000 and triple designation to markets with annual passenger demand of more than 1 million (see Table 2.3).

These double and triple designation rules were gradually extended in 1992 and 1996. As a result, the number of double and triple routes rose from 33 in the early 1990s to 51 by the late 1990s. The policy was repealed in 1997 and after this the market was not shared out by the Government.

The chronology of the process of liberalisation and an overview of airports in Japan are summarised in the following appendices.

Appendix D: Transition of liberalisation process in Japan and the EU
Appendix E: Main airports in Japan
Appendix F: Main airports in Japan (map)

Table 2.3: The double and triple designation rules

Year	Routes	Double designation	Triple designation
1970 1972		All trunk routes (All the routes from Tokyo to Sapporo, Osaka, Fukuoka, and Okinawa) Several local routes From Kagoshima, Nagasaki, Oita and Hakodate	
1986	The routes connecting Tokyo, Sapporo, Nagoya, Osaka, Fukuoka , Kagoshima and Okinawa	Annual passenger demand more than 300,000	Annual passenger demand more than 600,000
1986	Other routes	Annual passenger demand more than 700,000	Annual passenger demand more than 1 million
1992	The routes connecting Tokyo, Sapporo, Nagoya, Osaka, Fukuoka , Kagoshima, Okinawa, Hiroshima and Sendai	Annual passenger demand more than 300,000	Annual passenger demand more than 600,000
1992	Other routes	Annual passenger demand more than 400,000	Annual passenger demand more than 700,000
1996	All routes	Annual passenger demand more than 200,000	Annual passenger demand more than 350,000

For fare setting, airlines were required to obtain government approval even after deregulation. In 1995, the fare regulation was partly revised, with airlines allowed to set discount fares (up to 50%) after reporting them to the JCAB (Civil Aviation Bureau in Japan), but normal fares still needed government approval. In 1996, “the rule of the normal fare setting range” was enforced. This rule regulated the range of the normal fares on each route (see Table 2.4 and Figure 2.4). Standard costs are caluculated by the sum of average overating costs and “appropriate business profit” on the routes according to the airlines’ information.

Table 2.4: The rules of the normal fare setting range

The fare setting range

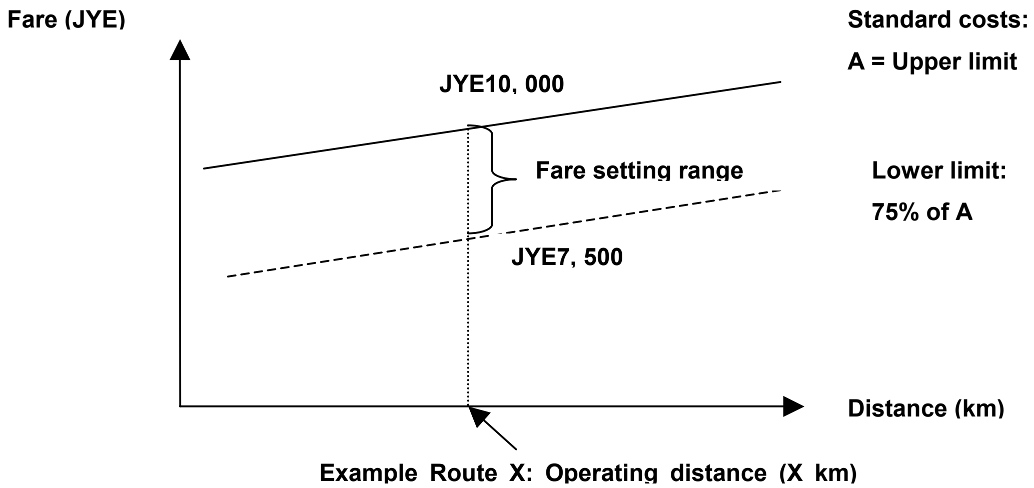
	Normal fares (fully flexible fares)	Discount fares
1996	Between Standard cost and 25% discount off the standard cost	> 50% discount off the standard cost
1998	Restriction of lower limit was abolished	
2000	Restriction of upper limit was abolished	

Under this registration, airlines were able to set fares in the fare setting range in order to promote competition. Each airline set discount fares (up to 50%) on several routes. However, the standard cost system enabled higher fare setting as an upper limit fare as it was computed by the average operating costs and "appropriate business profit" based on the airlines' information.

Kawaguchi (2000) analysed that fares were relatively more expensive on monopoly routes rather than on double and triple designation routes. As a result, all fares were raised after the enforcement of this fare setting range rule.

During the process of liberalisation from 1997, two new entrants, Skymark Airlines and Hokkaido International Airlines (Air Do) acquired an AOC (Airline Operating Certificate) and started operation in 1998. The lower limit of the fare setting range was abolished just before these new entrants started up. Skymark airlines set a 50% discount fare on the Tokyo-Fukuoka route when they started operation. In 2000, the upper limit of fare setting was abolished.

Figure 2.4: Example of the fare setting range in 1996



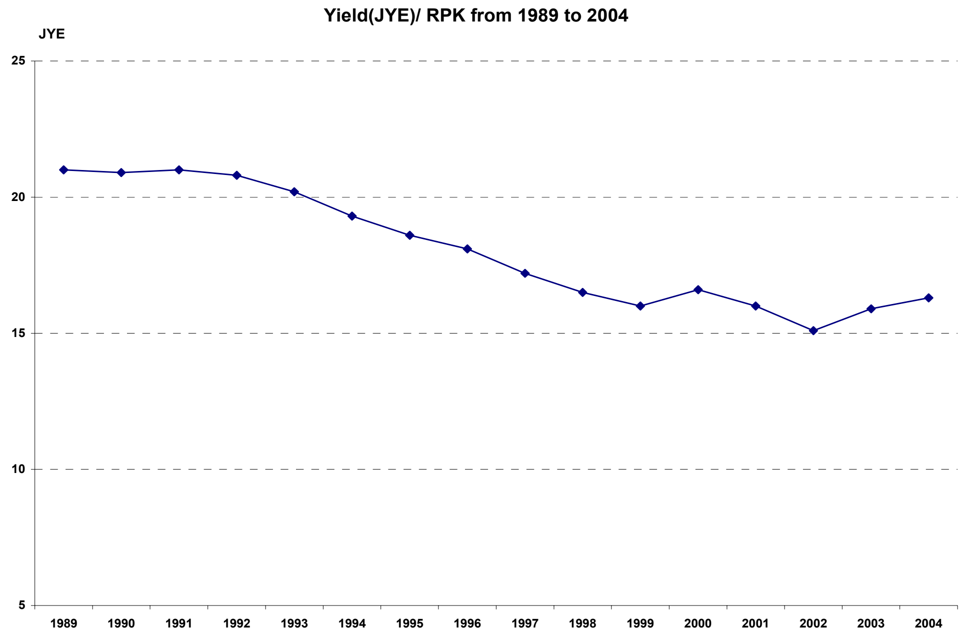
Notes: Standard costs = Average operating costs (on the double and triple designation routes) + "appropriate" business profit

2.2.3 Liberalisation in Japan

The Air Law was vastly revised in 2000, when the approval rule for each route was repealed. Airlines now have the obligation to obtain approval for only their business activity, with freedom to set fares by themselves, the only requirement being to provide advance notice to the JCAB. This revision has enabled each airline to operate any route it desires legally and to set its fares freely subject to advance notice being given.

The Ministry of Land, Infrastructure and Transport reported that deregulation had resulted in the average fare paid dropping dramatically on all the domestic routes and to have increased public interest in air travel (White Paper, 2003). Endo (2001) estimates that on average fares decreased by 30 % between 1985 and 1999 as a result of deregulation, the drastic drop being caused by new entrants and the extension of slot allocations at Haneda airport. Average yield dropped by 24% between 1989 and 1999 (see Figure.2.5).

Figure 2.5: Yield/ RPK in the Japanese domestic market



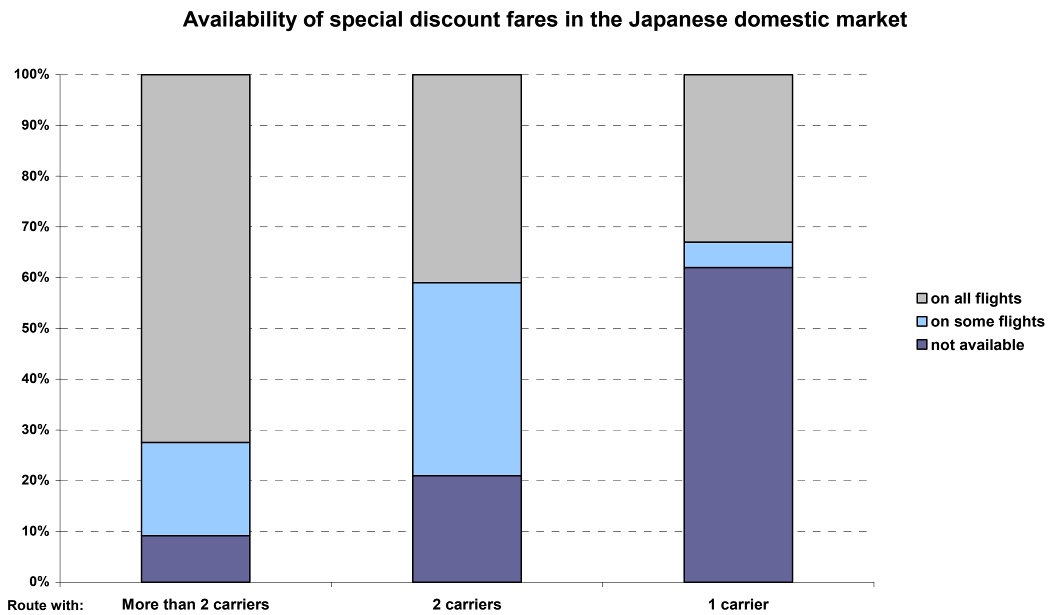
Source: Author based on data from Ministry of Infrastructure, Land and Transport (2004)

However, the average yield in the domestic market rose by 4% after liberalisation between 2002 and 2004. Moreover, availability of special discount fares in the whole domestic market has not increased. Figure 2.6 shows that special discount tickets were not available on more than 60% of flights on the monopoly routes after liberalisation.

Although new entrants such as Skymark and Air Do have had some effect on the market through heavy discounting, their financial impact on the incumbents has been limited. This is due to Japan's perennial slot shortages, which have prevented them from growing rapidly. Domestic deregulation therefore existed in theory, but not in practice. While international yields remain weak, domestic yields are improving, in part because the larger JAL group is able to attract more individual passengers than group travellers, which is a much more higher-yielding type of passenger."
(Japan Airlines Former CEO Isao Kaneko)[12]

[12] Airline Business, vol.20, no.4

Figure 2.6: Availability of special discount fares in the Japanese domestic market

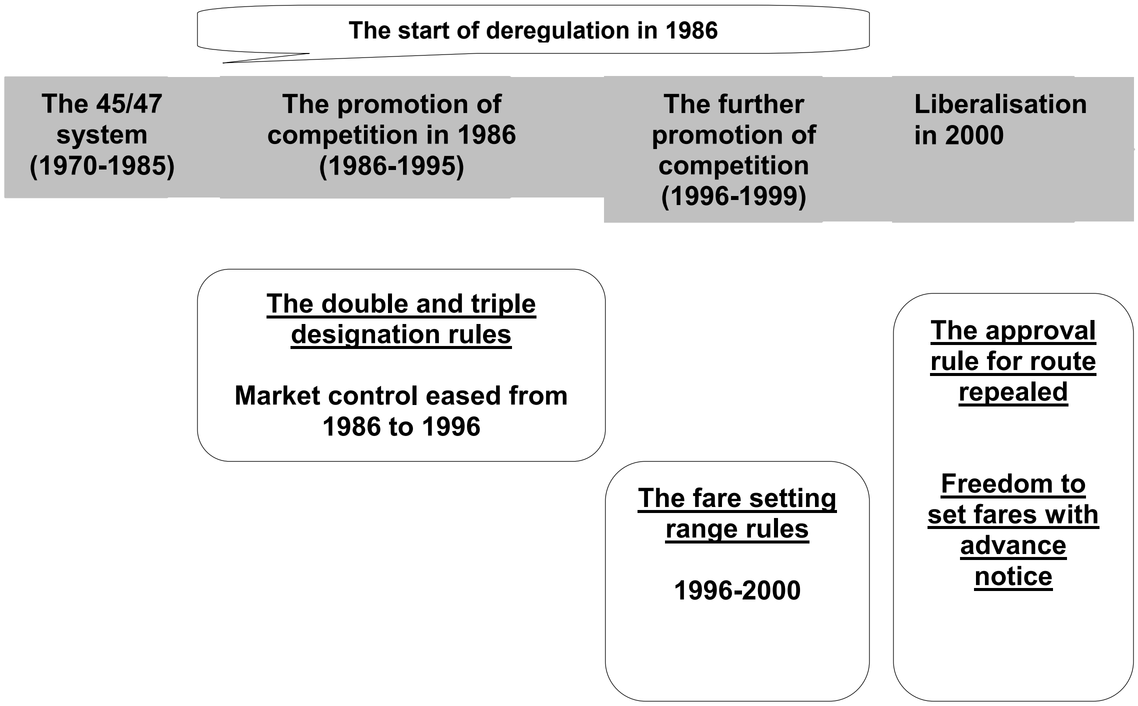


Source: Ministry of General Affairs (2004)

The domestic air transport market in Japan was strictly regulated and protected by Government since its start in 1951 after World War II. When the 45/47 system was repealed in 1985 at the start of deregulation, the process of liberalisation in the domestic market in Japan was introduced gradually between 1986 and 2000 in several stages. Fare setting rules were eased from 1996 to 2000 and several new entrants entered the high demand markets from 1998 (see Figure 2.7). Although some Japanese literature appreciated the effects of deregulation on on the market (supra, chapter 1) compared to the results of 1985 and 2000, evidence in this chapter demonstrates the different effects of liberalisation in the domestic market in Japan compared to those of other regions.

The results of liberalisation are analysed in the following chapters to compare with the situation before liberalisation in 2000.

Figure 2.7: The process of liberalisation in the domestic market in Japan



Chapter 3: The Tokyo routes market

3.1 Overview

The domestic air transport market in Japan has expanded in line with the development of the Japanese economy, which is concentrated and consolidated in Tokyo at the centre of Japan. Tokyo International airport (Haneda) is well known as being highly congested and some of the routes are ranked among the top 10 busiest routes in the world (see Table 3.1). Also of significance is that there is no secondary airport for the domestic routes serving this metropolitan city, which results in the operation of very large aircraft on short domestic sectors with a departure every thirty minutes.

Table 3.1: Top ten passenger traffic airports and main Asian airports in the world in 2003

Airport	Airport Code	Total passengers In 2003	Peak movements (hourly)
Hartsfield-Jackson Atlanta International	ATL	79,086,792	223
Chicago O'Hare International	ORD	69,508,672	186
London Heathrow	LHR	63,487,136	89
Tokyo International	**TYO**	**62,876,269**	**65**
Los Angeles International	LAX	54,982,838	112
Dallas/Fort Worth International	DFW	53,253,607	133
Frankfurt	FRA	48,351,664	89
Paris Charles de Gaulle	CDG	48,220,436	104
Amsterdam Schiphol	AMS	39,960,400	104
Denver International	DEN	37,505,138	153
Hong Kong International	HKG	27,092,290	56
Tokyo Narita International	**NRT**	**26,537,406**	**46**
Sydney Kingsford Smith International	SYD	25,333,508	68
Singapore Changi	SIN	24,664,137	43
Beijing Capital International	PEK	24,363,860	82

Source: Author based on the data from Air Transport Intelligence (2007)

However, the Tokyo market does not only consist of these very dense sectors, but also is composed of low demand routes. Thus the Tokyo routes cannot be described simply as there is a diversity of routes with many different features and issues. This chapter aims to identify these characteristics of the Tokyo routes market.

3.2 Market segmentation of the Tokyo routes

The market has been segmented into six groups according to the level of demand.

Table 3.2: Market segmentation of the Tokyo routes

Category	Annual number of passengers	Average Number of departures per day
1	More than 3,000,000	More than 50
2	2,000,000< 3,000,000	20 – 30
3	1,000,000 < 2,000,000	14 – 19
4	Less than 1,000,000	9 – 13
5		4 - 8
6		Less than 4

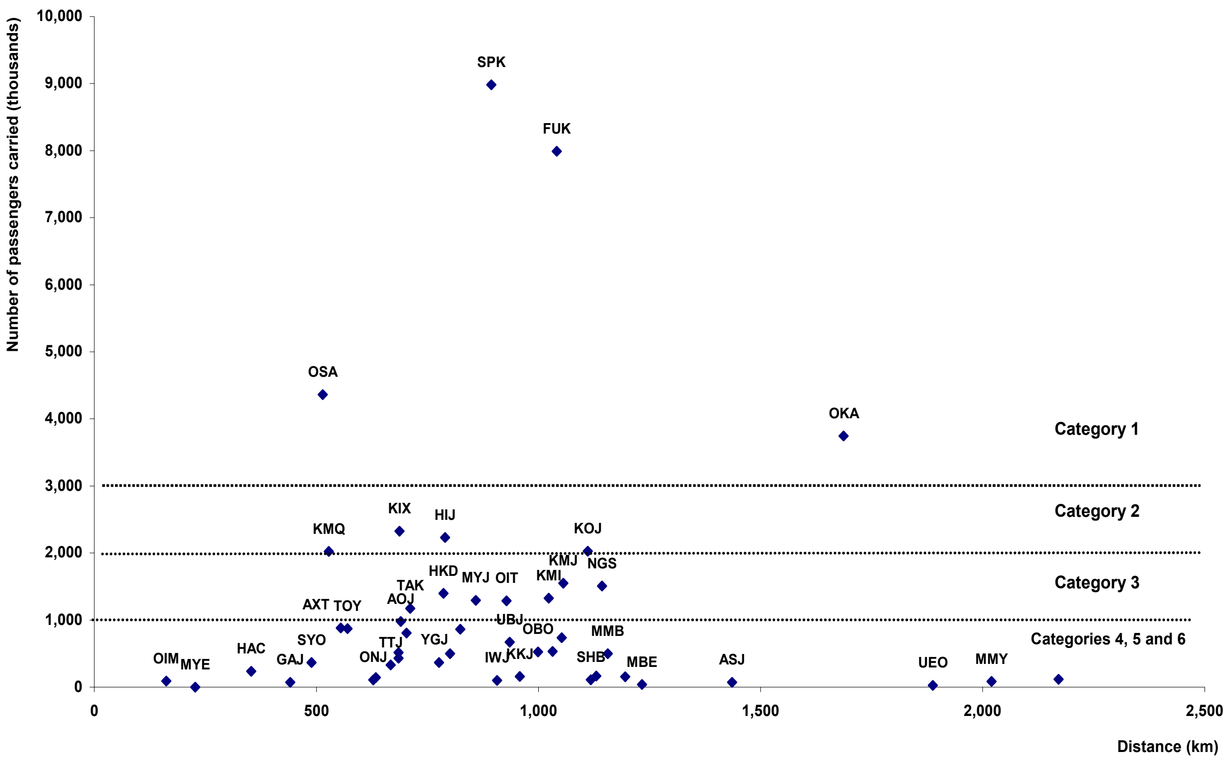
Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation Statistics (2000)

Figure 3.1 and Figure 3.2 show that there is an extensive range of demand and supply levels in the Tokyo routes. The categories 4, 5 and 6 form the majority of Tokyo routes, accounting for more than 65% of the total number of Tokyo flights serving local markets and remote islands. However, the total number of passengers flying these routes is less than half of the total on category 1 routes. There are seven prominent characteristics of the Tokyo routes market. These are:

- Volume of demand
- Influence of slots
- Different features of each category market
- The relatively low load factors
- The market seasonality
- Competition with high speed railway service
- High fare

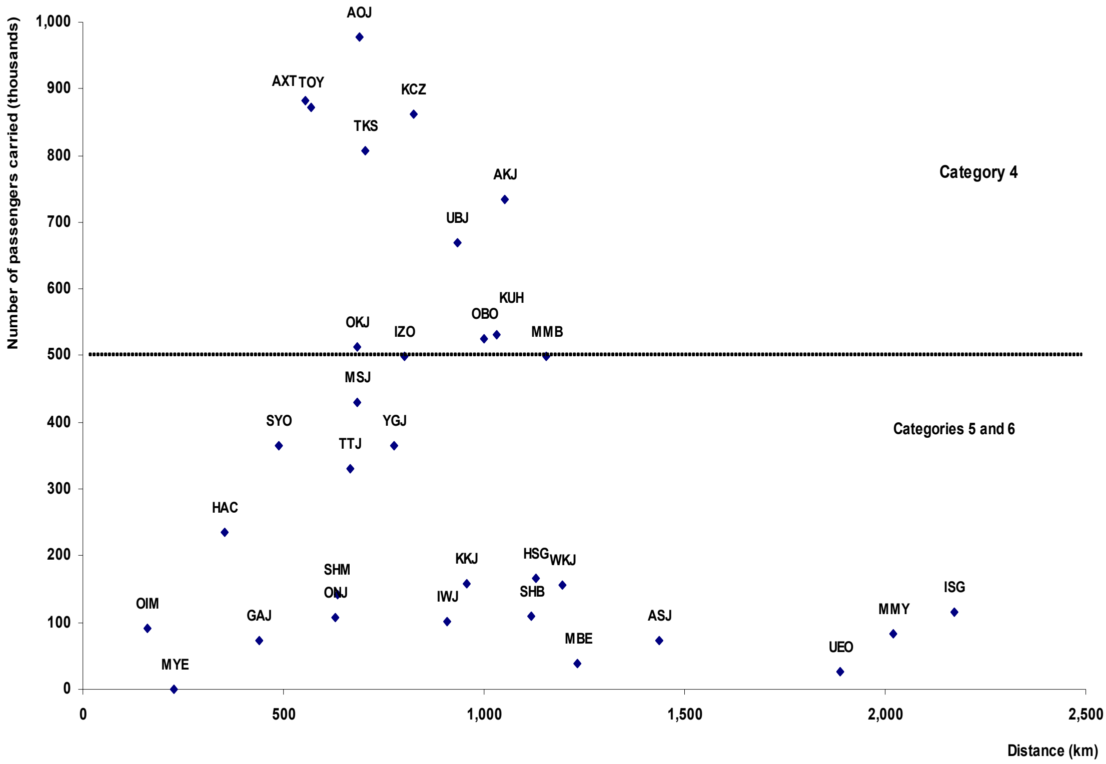
Detailed information is found in appendix G: Market segmentations of the Tokyo routes and key characteristics in 2000.

Figure 3.1: The number of passengers carried annually on Tokyo domestic routes in 2000



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation Statistics (2000)

Figure 3.2: Passengers carried and distance in Categories 4, 5 and 6 in 2000



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation Statistics (2000)

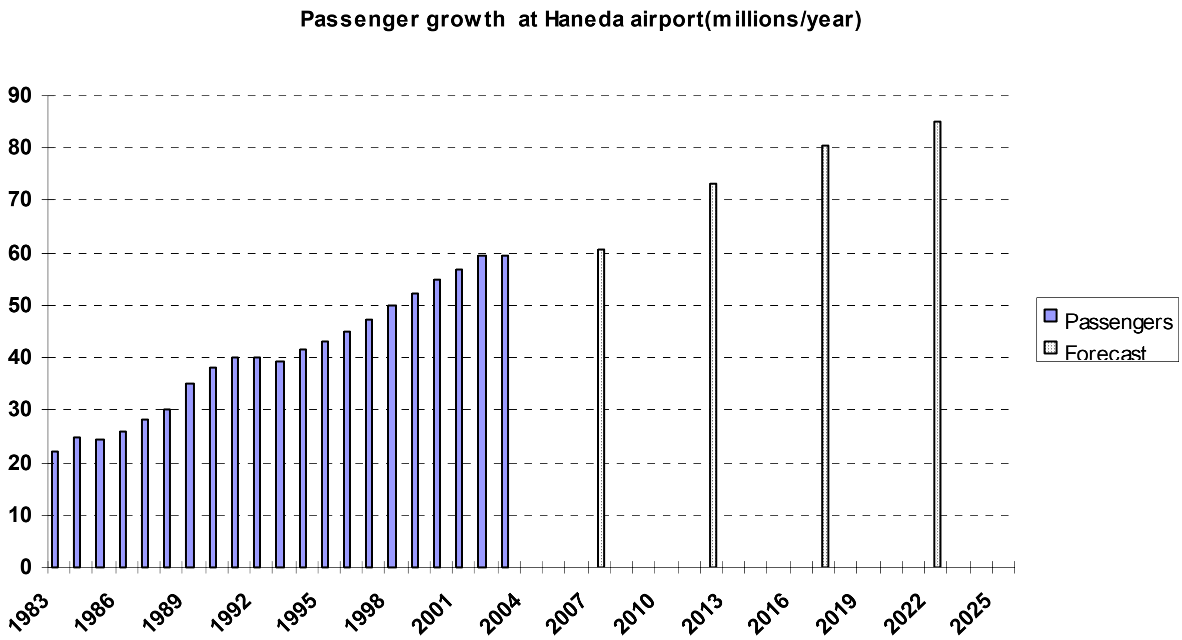
3.3 Characteristics of the Tokyo routes

3.3.1 Volume of demand

In 2002, the total number of passengers on Tokyo domestic routes was 59,462,156 and the number of daily flights was 392, comprising 61.5% of all domestic air transport activity in Japan. The number of passengers on Tokyo routes has been increasing constantly despite a prolonged recession of the Japanese economy.

According to the statistical records, in 2001 the 10 busiest domestic routes were all Tokyo sectors (see Table 3.3). The Ministry of Land, Infrastructure and Transport expects total passenger demand at Haneda airport will exceed over 73 million passengers per year by 2013, compared to the 57 million passengers that used the airport in 2004 (see Figure 3.3).

Figure 3.3: Passenger growth at Haneda airport



Source: Ministry of Infrastructure, land, and Transport, White paper (2004)

Table 3.3: Ten busiest domestic Japanese routes in 2001

Passengers	Route	HHI	Market share by Carrier (%)
9,367,334	Tokyo-Sapporo	0.31	JL(35), JD(19), NH(38), HD(9)
8,264,938	Tokyo-Fukuoka	0.29	JL(30), JD(20), NH(39), BC(11)
4,964,395	Tokyo-Osaka	0.35	JL(36), JD(23), NH(41)
3,913,802	Tokyo-Naha (Okinawa)	0.36	JL(42), JD(14), NH(41), NU(3)
2,382,913	Tokyo Kansai	0.43	JL(42), JD(8.3), NH(49.6), EL(0.1)
2,317,884	Tokyo- Hiroshima	0.42	JL(19), JD(24), NH(57)
2,111,348	Tokyo- Kagoshima	0.36	JL(26), JD(28), NH(47)
2,042,866	Tokyo-Komatsu	0.34	JL(30), JD(29), NH(41)
1,616,606	Tokyo- Kumamoto	0.35	JL(24), JD(37), NH(39)
1,496,330	Tokyo-Hakodate	0.51	JL(45), NH(55)

Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2001)

Notes: One way trips, JL: Japan Airlines, JD: Japan Air System, NH: All Nippon Airways, HD: Hokkaido International Airlines, BC: Skymark Airlines, NU: Nippon Trans-ocean Airlines, EL: Air Nippon

3.3.2 Influence of slots

It is generally acknowledged that the lack of slots has been a bottleneck for air transport and has produced unusual particularities in this market. Haneda airport is well known for the 528 seats Boeing 747SR jets that are operating on the short sectors every ten minutes in peak periods. It has been argued by the airlines and aircraft manufacturers that this has resulted from the lack of slots.

The average number of available seats per flight on Tokyo routes in 2002 was 330. The equivalent figure for Heathrow was 140, Gatwick 94 and Frankfurt 124. The majority of Tokyo routes have between 100 and 250 passengers per flight, although the average numbers of passengers carried varied between routes. Larger aircraft are operated on the Tokyo routes compared to similar routes in other countries. However, the gap between supply and demand on the routes can not be explained only because of the lack of slots. Another question raised here is why the average load factor is relatively very low in these highly congested markets and yet the airlines achieve good profits, which can cover for the low yields on the international flights even after deregulation. The key to this question can be found in the characteristics of the Tokyo routes. The slot allocation system at Haneda airport will be discussed in detail in the following chapters 5 and 6.

3.3.3 Different features of each market category

There are also other prominent features of this market apart from the differences in market size (see Table 3.4 and Appendix G). They are the "relatively low load factors" compared with other countries, even on the high demand routes, and the "market seasonality". Besides, "Competition with the high speed railway service" is also one of the outstanding features of this market.

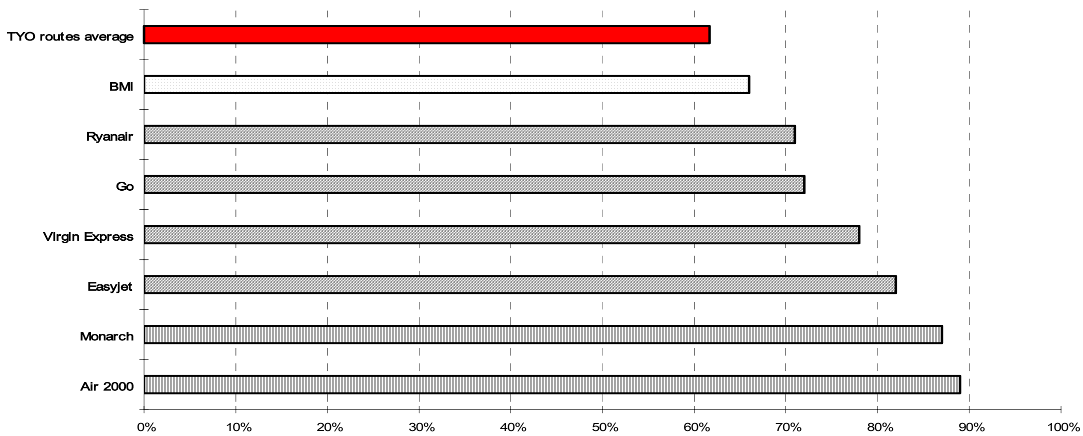
Table 3.4: Market segmentation of the Tokyo routes and key characteristics in 2000

Category	Characteristics	Average Load factor (%)	Average Number of passengers per flight	Number of airlines
1	High demand market	68.0	289	4
2	Competitive market	65.1	231	3
3	Local centre and strong VFR market	63.4	200	2
4	Local city market	62.4	169	2
5	Secondary and newly opened airport market	58.6	133	1
6	Remote islands market	66.5	83	1

3.3.4 The relatively low load factors

Table 3.4 shows the key characteristics of each route category. Categories 1 and 2 are mainly operated twice every hour by B747-SR, which has more than 520 seats. However, the average load factor is less than 70 % in category 1 routes. The average load factor of the Tokyo domestic market is 61% which is low compared with the EU market (see Figure 3.4). It is generally recognised that airlines have been operating larger aircraft to provide enough supply to cover the high demand experienced during seasonal and periodic peak times. During peak periods, high profits result from the expensive fares charged without any discounts available.

Figure 3.4: Average passenger load factors in 2003



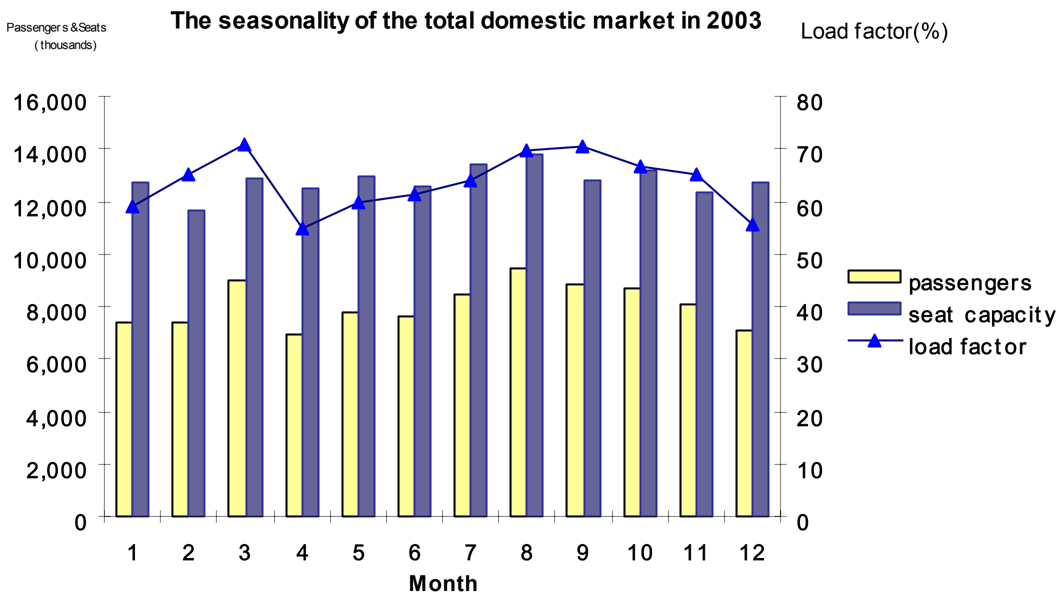
Source: Composed by the author based on the data of Market Analysis of Europe's Low Cost Airlines (2004) and Aviation statistics in Japan (2003)

3.3.5 The market seasonality

Seasonality is another outstanding characteristic of the domestic market in Japan. There are several peak demand seasons in a year, which are during the New Year, mid–summer and so-called golden week holidays (from the end of April to the beginning of May). Each is only for 7 to 10 days. During these periods, massive numbers of people are moving from the big cities to their home towns or sightseeing places at the same time by all modes of transportation. At these times, people take their holidays, which have come from conventional Japanese customs. It still remains among the business customs and life styles in Japanese culture even though this trend has changed slightly over time.

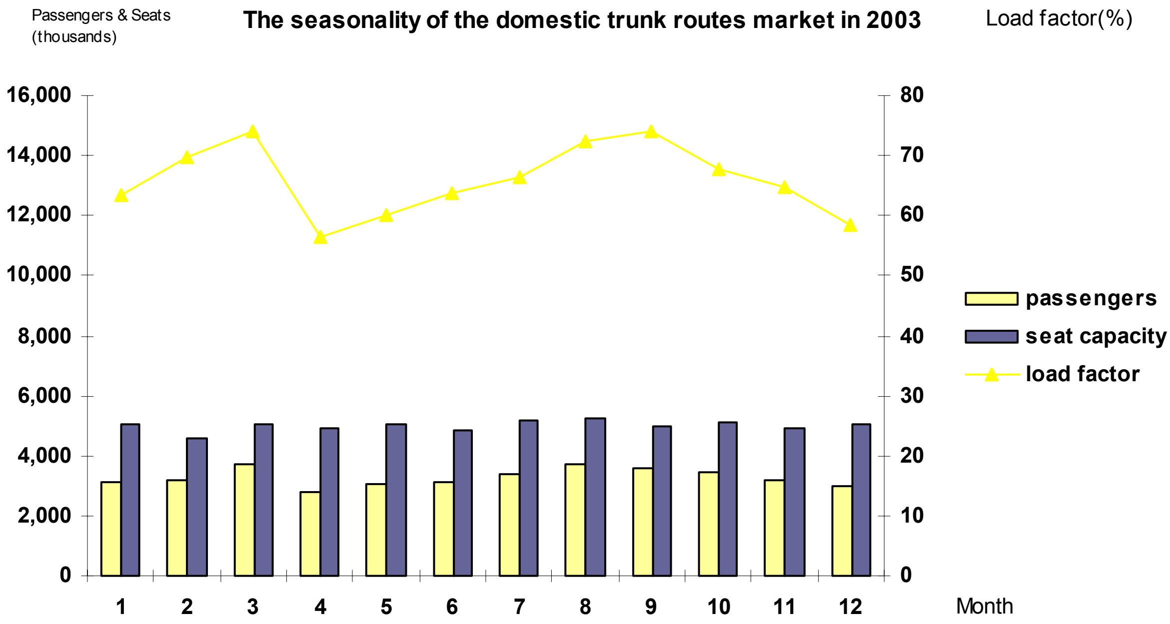
The number of passengers carried increases in January, August and December, because of the summer and New Year vacation seasons (mainly during 7-17 August and 27 December-10 January). Figure 3.5 shows that load factors in December and January are moderately low. However, almost 100 % load factors are achieved during these peak periods with extra services operated to cover the demand for these two weeks. Figures 3.6 and 3.7 show that local route markets show these patterns are inclined to as well.

Figure 3.5: The seasonality of the total domestic market in 2003



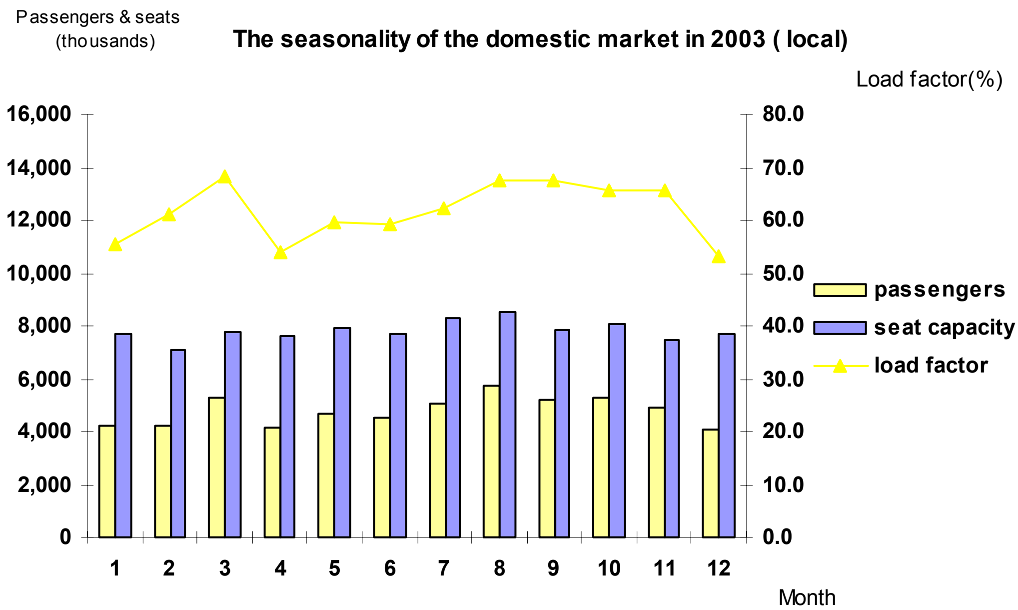
Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2003)

Figure 3.6: The seasonality of the domestic trunk routes in 2003



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2003)

Figure 3.7: The seasonality of the domestic local routes market in 2003



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2003)

3.3.6 Competition with high speed rail

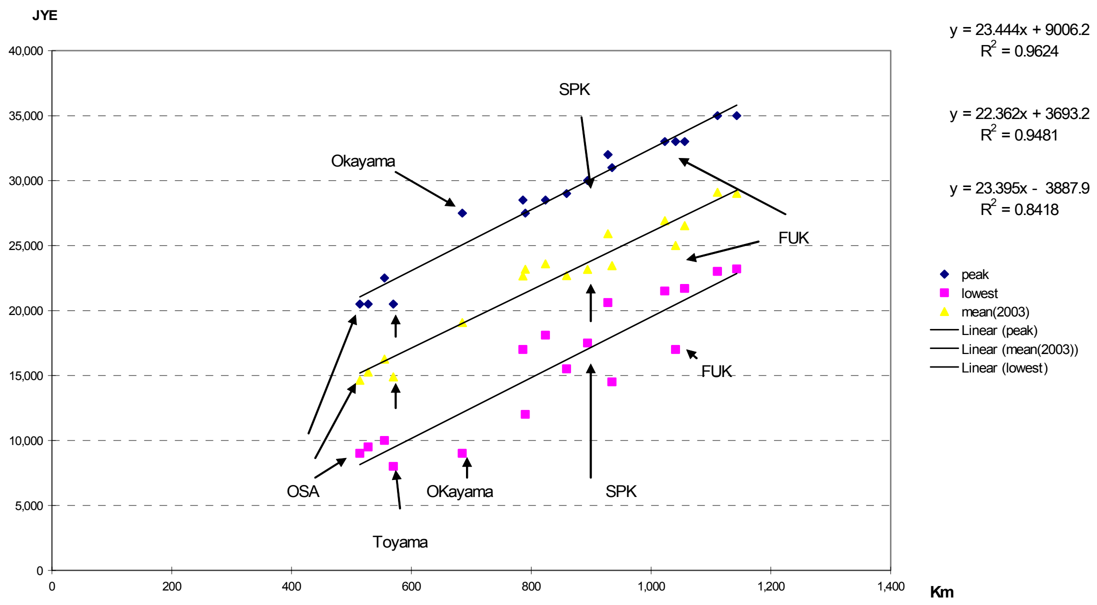
Competition with high speed rail is another prominent characteristic of the domestic market in Japan. Therefore, this is such an important characteristic of the Tokyo routes that it is dealt with in great detail in the ensuring chaper 4.

3.3.7 High fares

Fares have been decided and fixed according to the distance in the Japanese domestic market. This has not changed even after liberalisation. The difference between the highest and lowest fares is also constant among most routes. Figure 3.9 shows Japan Airlines' fares in June 2003 after liberalisation. Only on several routes which have competition with HSR or new entrants were discount fares set a little lower than average discount fares. On the other hand, peak fares were raised more on these routes.

Generally, fare types have been segmented into four kinds, which are (1) the fully flexible fare (called the "normal fare" in Japanese), (2) the advanced booking discount fare, called "Maeuri" or "Tokuteibin", (3) the ticket book fares and (4) other special promotion fares. The advanced booking discount fares restrict the booking periods, which vary from 47 days to 1 day before departure. The majority of these advanced booking discount tickets are available from 21 days, 7 days and 1 day before departure. The difference between the peak and lowest discount fares is not so significant on most of the routes. These attributes are one of the prominent characteristics of the Tokyo routes market. How fares have been changed pre-and post-liberalisation will be analysed in section 6 of chapter 6.

Figure 3.8: Japan Airlines' fares in June 2003



Source: Author based on the data from Japan Airlines' timetable and Ministry of Land, Infrastructure and Transport, Aviation statistics (2003)

Note: Remote islands routes are not included. Three letter code refers the airport, SPK(Sapporo), FUK(Fukuoka) and OSA(Osaka).

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Chapter 4: Competition between air transport and high speed rail

4.1 Introduction

Competition does not only exist between airlines but also between airlines and other modes of transport, especially high speed rail (HSR). In Japan the high-speed railway service "Shinkansen" has been operating since 1964. The network has been developed and expanded in much the same way as air transport in response to the economic development of Japan. Some flight routes from Haneda airport overlap with the high speed railway network, and now more than 30% of Tokyo air routes compete with high speed rail (see Figure 3.8).

Air services on the Tokyo-Nagoya (366 kms) and Tokyo-Sendai (352 kms) routes have been reduced as a result of the effects of the high speed railway service. Kroes (1998) and Park and Ha (2006) mentioned difficulties for air services to compete with HSR in Japan. However, some Tokyo air routes have experienced increasing demand as a result of the positive effects of competition following deregulation of air transport, excluding routes serving remote islands.

How much have these positive effects of competition affected the market and what are the key determinants that can stimulate travel if there are modal options for passengers? In the Tokyo routes market, which has experienced expanded networks of both HSR and air transport, this chapter attempts to investigate the key determinants of competition.

An extensive literature search has been undertaken into competition between HSR and air transport. Many studies involve behavioural choice analysis using discreet choice models. These studies provide valuation of travel attributes; relative valuations include money values of time and fare equivalents; price and cross price elasticity, which indicate the sensitivity of demand to change in a single attribute (Eurocontrol, 2004). It is clear that three hours journey time is generally recognised as the threshold point for competition.

Among the studies of the European market, Blayac and Causse (2001) analysed the long distance market in France and Mandel et al (1994) studied medium range routes in the German domestic market. Gonzalez-Savignat (2001) evaluated the potential of the HSR on the Madrid-Barcelona route in Spain. In Japanese literature, Terao et al (2001) used a modal choice model to analyse competition between HSR and air transport on medium range routes (450 kms) and estimated that a 12% fare discount on HSR increases rail demand by 3% and a 43% discount of the HSR fare increases rail demand by 10%. Yao et al (2005) revealed that business travel is more sensitive to changes in travel time, access time and service frequency than non-business trips. Most studies demonstrate the importance of the relationship between the features of a market and passengers' modal choice using time and fare as the key variables. Markets are segmented generally by distance, with HSR dominating up to 350 kms, and air transport dominating over 1,000 kms (Eurocontrol report, 2004).

Competition between HSR and air transport has been analysed on the basis of journey time and fare. However, because of the limitations of fare data, many studies have estimated average fares for modelling purposes. This study attempts to show the relationship in greater detail between these factors using indices computed from actual fare data.

This chapter is structured as follows: firstly an outline of high-speed rail services in Japan is given followed by some examples in several regions; and secondly, the characteristics of the domestic air routes serving Tokyo are outlined. The relationship and differentiation of services between HSR and air transport using indices (demand, supply, frequency, fares, speed and access time) are then analysed in comparison with several domestic routes in France. A summary of the study forms the final section of this chapter 4.

4.2 High speed railways in several regions

High-speed trains have been operating for many years in Western Europe, the US and eastern Asia. In France the Sociéte Nationale des Chemins de Fer français (SNCF) started high speed operations between Paris and Lyon in 1981, which has been followed by a further six TGV lines.[13]

In Western Europe, competition between high-speed rail services and low cost air carriers has been evident. On the Paris-Marseille route, the air modal share dropped from 45-55% to 35-45 % as a result of the introduction of high speed rail services (Park and Ha, 2006). Table 4.1 shows that relatively low fares existed on European rail services compared with other regions. This is the effect of competition with air transport. On TGV sectors, the average speed is more than 250km/h, which is the same as the Japanese Shinkansen. However, the fare is only between 5.5 and 10 US cents per km in France, while it costs more than 22 to 36 US cents in Japan. The latter are almost the same as the Eurostar lines, which are operating through the Channel tunnel.

Appendix H: High speed rail and fares in several regions

4.3 High speed railway network in Japan

In Japan, the birth place of high-speed trains, the first HSR operation was started between Tokyo and Osaka in 1964. In 1975 the HSR was extended to Fukuoka and since then the high speed rail network has been increased to 2,418 kms comprising eight bullet train (Shinkansen) lines of the Japan Railways Group in 2005.

Table 4.2 compares the length and density of high speed rail networks in selected countries of the EU and Japan in 2003. It can be seen that the high-speed rail network density in Japan is more than three times that of the French network.

[13] They are TGV Atlantique (opened 1989-90), TGV Rhône Alpes(1992-94), TGV Nord Europe (1993), TGV Jonction (1994-96) and TGV Méditerranée (2001).

Table 4.1: Examples of high speed rail services and fares

	From	To	Cheapest fare (USD)	Standard fare(USD)	Cheapest fare(USD)/km	Standard Fare(USD)/km
France	Lyon	Aix-en-Provence	23.0	47.8	7.9	16.5
	Lyon	Avignon	53.2	82.3	8.1	12.5
	Lyon	Aix-en-Provence	57.5	82.3	7.9	11.3
Japan	Nagoya	Tokyo	91.8	91.8	25.1	25.1
	HIroshima	Kokura	65.8	65.8	34.3	34.3
	Shin-Kobe	Okayama	51.6	51.6	36.0	36.0
	Omiya	Sendai	46.5	46.5	14.5	14.5
	Shin-Yokohama	Nagoya	86.5	86.5	25.6	25.6
	Shin-Kobe	Tokyo	125.0	125.0	21.2	21.2
European	Brussels	Valence	90.8	110.1	10.9	13.2
	Brussels	Paris	66.6	66.6	21.2	21.2
	Ashford	Paris	180.3	180.3	44.9	44.9
Korea	Seoul	Daejeon	20.0	20.0	12.9	12.9
	Seol	Busan	45.9	45.9	11.2	11.2

Source: Author, Fares are acquired from the companies websites in April 2006.

Notes: The exchange rates used were the Representative Rates for Selected Currencies, as reported in the exchange rate archives of the International Monetary Fund.

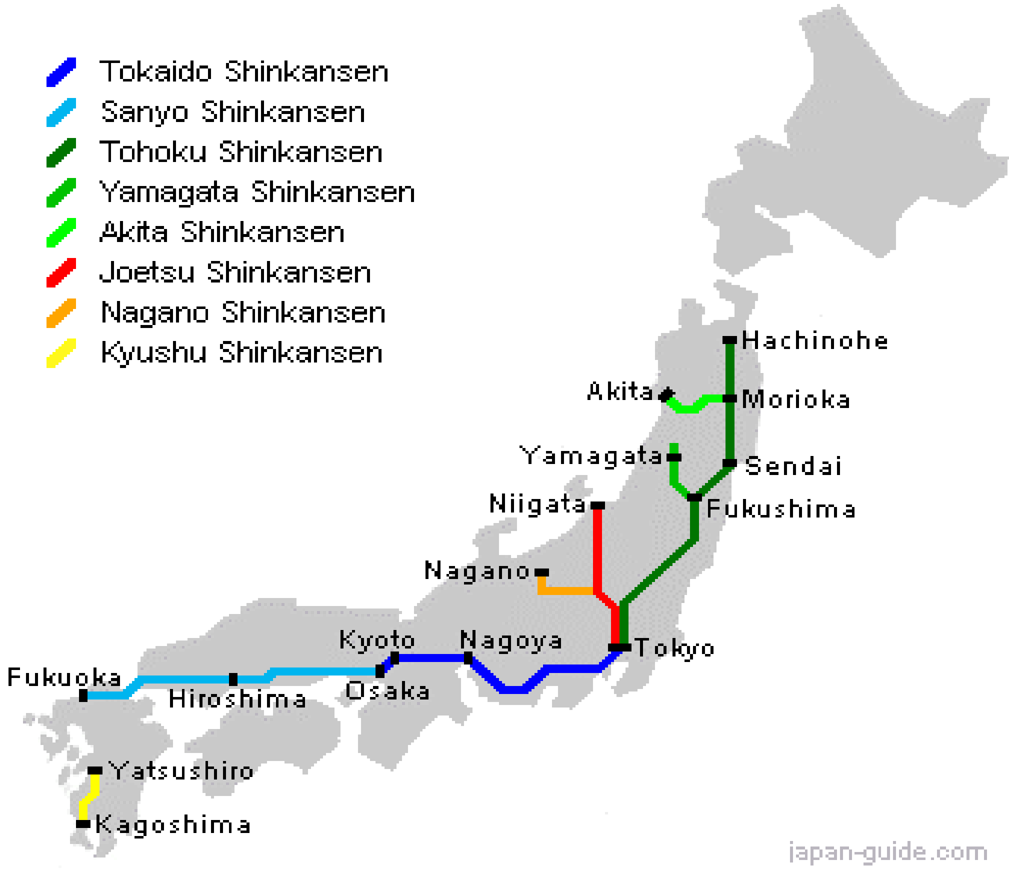
Table 4.2: High speed railway networks

	UK	Germany	Spain	France	Italy	Japan
Length (km)	140	645	377	1,400	237	2,275
Lines Density (m/sq km)	0.58	1.85	0.76	1.47	0.13	6.04

Source: Author based on the data from Union Internationale des Chemins de Fer and United Nations Statistics Division.

Notes: Length of lines where the maximum speed of the train can exceed 250km/h (km). Line density = length of lines/area square km.

Figure 4.1: High speed railway (Shinkansen) networks in Japan

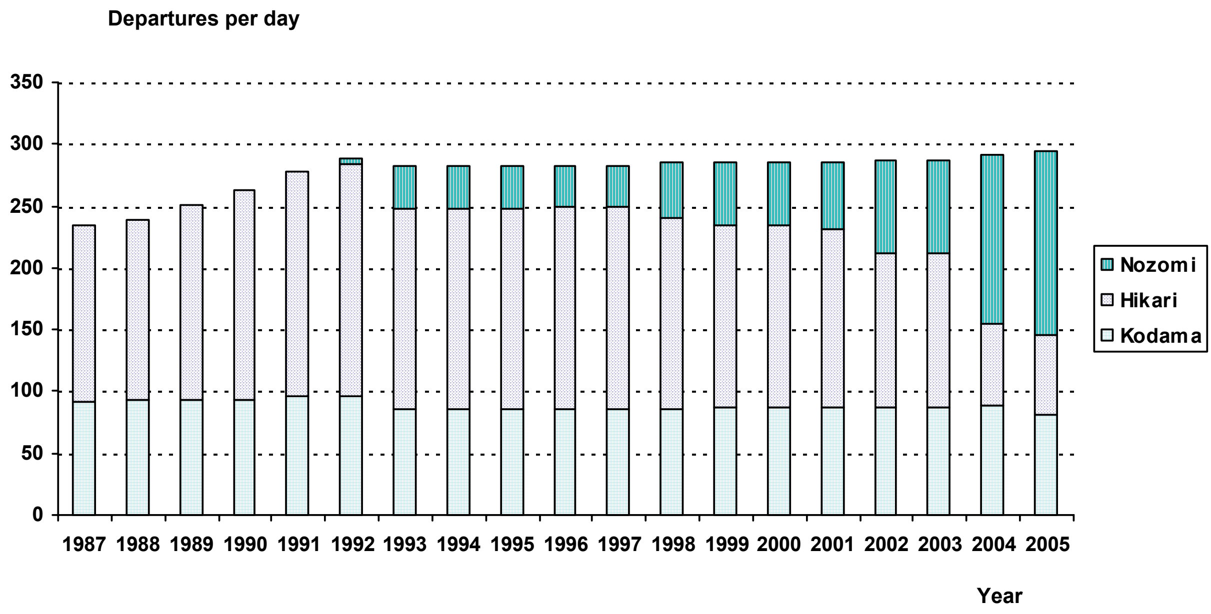


Source: japan-guide.com http://www.japan-guide.com/e/e2018.html

Not only the length and density of lines but also frequency is very high in Japan. In the case of the busiest line, Tokaido Shinkansen, the total number of departures operated between Tokyo and Osaka became 295 per day including 149 Nozomi (only 3 stops operation) trains and 65 Hikari (5 stops operation) trains in 2005.

Nozomi departures increased to 137 from 75 in October 2003 to increase capacity and improve the flexibility of the timetable to compete with air transport (See Figure 4.2). At peak operating periods, seven Nozomi, two Hikari and three Kodama trains depart per hour in each direction from Osaka and Tokyo. The Tokaido high speed railways' revenue accounted for 84 % (JYE 914 billion) of the total Central Japan Railways revenue in 2004, according to their financial report.

Figure 4.2: Total number of departures per day from Tokyo to Osaka (Tokaido high speed railway)



Source: Central Japan Railway Company, Annual Report 2003 and the website data in 2006

Note: Nozomi, Hikari and Kodama are the types of services. Nozomi service's maximum speed is 285km/h by the Series 700 train. Hikari service is operated by the Series 300 train (maximum speed : 270km/h).The Series 100 (the maximum speed : 220km/h) is mainly used for Kodama service. The acceleration force of the Series 700 has increased compare with the Series 100 and 300 by 16%.

4.4 Customer value chain analysis

4.4.1 Mechanism of customer value chain

In order to examine competition between air transport and HSR, a Customer value chain analysis approach is followed. This study attempts to explain the mechanism of Customer Value Chain analysis (CVCA) in order to find key determinants of competition using both marketing and a system engineering approach. As such, Customer Value Chain Analysis extends the functionality and utility of the Customer Chain by requiring designers to investigate the value relationships, or value propositions between the various customers (Donaldson et al, 2006, Takahashi, 2003). Figure 4.3 shows an example of the Customer value chain in air transport and illustrates the air transport service system diagram, which inputs "Human", and transforms and adds values to the Human throughout several stages of service delivery process.

Figure 4.3: Customer value chain of the air transport service system

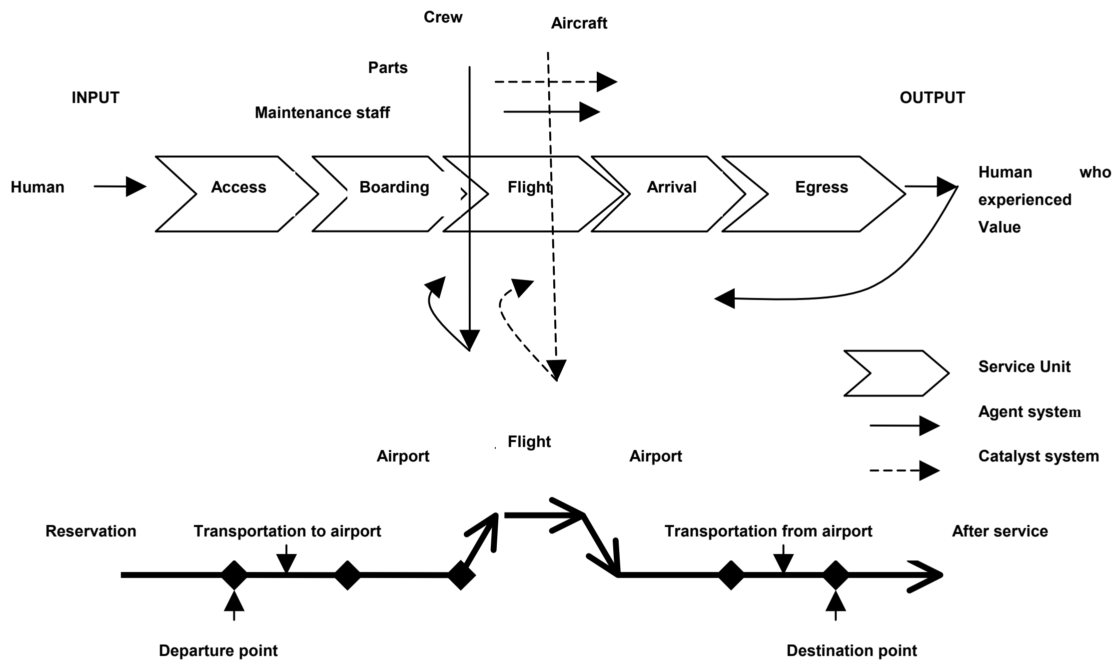


Table 4.3: Terms in Customer Value Chain Analysis

Customer value chain	The series of functions to produce values for customer
Service system	The system to transform “Human” to “Human who experienced values”.
Support system	The system to support service system
Unit	Structural element to compose service system
Catalyst	Element to operate the function of system
Agent	Element to operate the function of system by human
Objective	Aim of the system
Function	Core and supplementary function relate to “Aim” of the system. The choice of core function becomes a mission and the reasons of choice and methodology are the strategy of the system.

Source: Composed by author based on the study by Nadler (1991), Porter (1999, 2001 and 2002) and Takahashi (1993, 2003 and 2004)

In the case of manufacturing, the inputted materials are transformed to products. This value chain is composed of each unit that provides different functions. Each unit is supported by other support systems to provide catalysts or agents in each unit. For example, “Flight” unit is supported by the “Flight crew providing system” and “Aircraft providing system” in order to operate functions of this unit. All of the units have the same objectives of the system so reinforce each other. This system should be designed in order to pursue these objectives. Moreover, all of the elements of this system such as units, agents and catalysts should share the Value of this system in order to pursue the objectives of the system.

This system is designed for “Human” valuation. Value is therefore not value for the system but for the “Human”. Value is experienced and evaluated by customers during the process of the system. Heskett et al (1997) explained that customers make decisions about purchasing goods and services based on their own evaluations. In order to sustain and keep this system, it is important to keep customer’s loyalty (Albrecht et al, 2003) by improving “Customer Value”. Hence, the maximisation of customer value drives competitive power for sustainability of the system.
It is represented by the so-called “Customer value equation” (Heskett et al, 1997), as follows:

Equation : Customer value equation

$$\text{“}CV = S / C\text{”} \tag{4.1}$$

where CV is Customer’s value,

S is the sum of utilities that the customers gained

C is the total cost to acquire the service or good (for example, Fare + the cost of access including the transportation cost between airport and departure and destination point, and the cost for reservation or purchasing like a phone call and credit card charge)

In addition, the sum of utilities is represented as follows.

$$S \in F = F0 + F1 + F1 + F2 + \ldots\ldots + Fn \tag{4.2}$$

$$F = F0 + F1 + F1 + F2 + \ldots\ldots + Fn \tag{4.3}$$

∵ F0, F1, F2,… Fn are each functions expressing the utilities that each service or good provides.

(For example, safety, comfort, speed, food, drinks, punctuality, etc)

These functions are provided tangibly and intangibly in the case of transportation service and represent attributes of service important to customers (see Table 4.4). In these functions, speed is a tangible and observable factor both for customers and service providers, as well as being a key element of transportation. Price and speed are the most crucial factors of transportation service and represent the core parts of Customer Value, which indicate the strength of competition. In addition, these factors are crucial in the "Customer Value Equation" with Speed in the numerator and price in the denominator. Hence, in this study, competition with high speed railway services is analysed focusing on these tangible factors, Journey Time (speed) and Fare (price) as key level of services (LOS) variables.

Table 4.4: Tangible and intangible services provided in the customer value chain in the air transport service system categorised on SERVQAL.

SERVQAL	SERVQAL indices for air transport service
Reliability	Reliability
Assurance	Assurance
Tangibles	Facilities, Employees, Flight patterns, Speed, Fare
Empathy	Customisation, Responsive

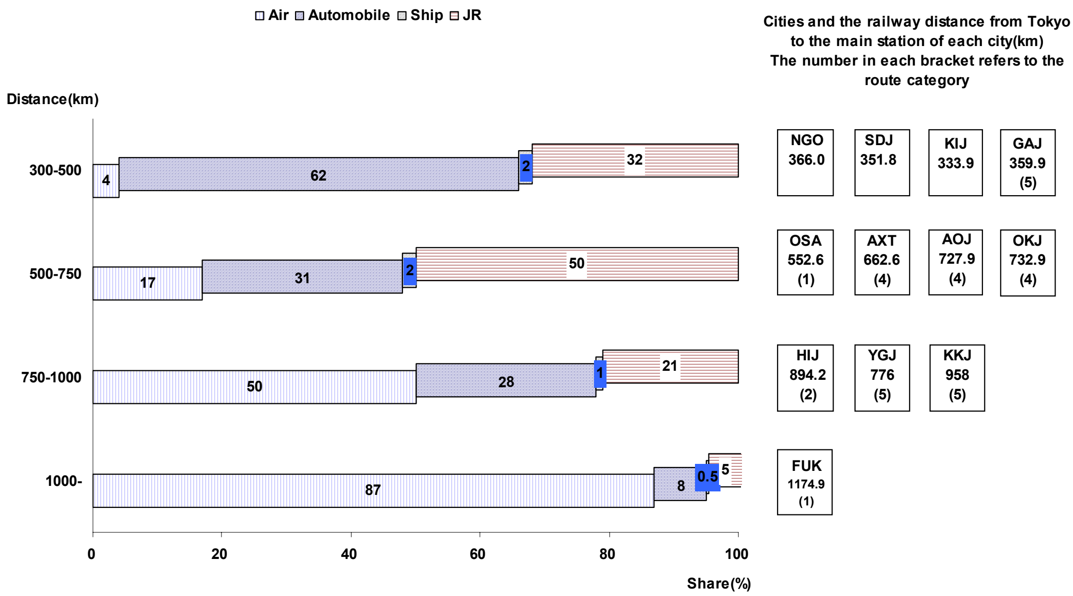
Source: Composed by the author based on the study by Parasuraman et al (1985, 1988) and Gilbert and Wong (2003).

4.5 Competition between air transport and high-speed rail

In this section, competition between air transport and high speed rail serving Tokyo routes is analysed by using important tangible factors Time (speed) and Fare (price), which were discussed in the previous section.

Figure 4.4 shows the modal shares on each sector for Tokyo routes. With several modes of transportation competing, service attributes become an important factor in the choice of transportation. Japan is one of the countries, where the high speed railway network has been expanded. It is also demonstrated that many air routes from Haneda airport overlap with this high speed rail (HSR) network and that the markets which have a route distance of less than 500 km from Tokyo are already dominated by HSR.

Figure 4.4: Competition with Japan railway services (JR)



Source: Composed by auther based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2003) and Central Japan railways (2003)

Note: The distance is the train distance between Tokyo station and the main station of each local city. The three letter codes are the names of airports located at each local city; NGO(Nagoya), SDJ(Sendai), KIJ(Niigata), GAJ(Yamagata), OSA(Osaka), AXT(Akita), AOJ(Aomori), OKA(Okayama), HIJ(Hiroshima), YGJ(Yonago), KKJ(Kitakyushu) and FUK(Fukuoka)

Air transport accounts for 87% of demand on the Tokyo–Fukuoka route and 50% on the Tokyo – Hiroshima route. The former is because of the much shorter overall journey time by air. Trip duration on Tokyo-Fukuoka is almost the same as for the Tokyo–Osaka route. Journey distances of between 550 km and 1,000 km are a critical point of competition between JR and air transport, as flight journey times are almost the same as the train (see Appendix I : Modal share in the total domestic transportation in Japan).

In order to compare the degree of competition between air services and JR on each route, “Time indices” and “Fare indices” were calculated. Table 4.5 gives examples of these Time and Fare indices, which have been computed using data for June 2005. Each index shows the ratio of air transport to that of JR. They are computed by comparing the total required travel time and costs, including the access process. All air fares and access fares were acquired from timetables. The cheapest public transportation has been adopted for these calculations. To compute the time index, in the case of air transport thirteen minutes was added to the average flight and access time to cover the additional time caused by check-in and allowing for some delay (see Table 4.6).

Table 4.5: Time indices and fare indices comparing air and JR in June 2005

Name of stations and Airports(destination) from Tokyo	Category	time index	Fare index			
			Normal	Peak	Discount highest	Lowest
Sapporo/ Sapporo(SPK)	1	0.29	1.14	1.32	1.19	0.96
Hakata/ Fukuoka(FUK)	1	0.48	1.09	1.48	1.11	0.80
Shin-Osaka/ Osaka(OSA)	1	0.93	1.37	1.46	1.50	1.36
Hiroshima/ Hiroshima(HIJ)	2	0.73	1.44	1.51	0.99	0.83
Akita/ Akita(AXT)	4	0.74	1.26	1.34	1.01	0.80
Aomori/ Aomori(AOJ)	4	0.67	1.55	1.63	1.34	1.14
Okayama/ Okayama(OKJ)	4	0.80	1.55	1.63	0.88	0.73
Yamagata/ Yamagata(GAJ)	5	0.86	1.42	1.54	1.66	1.66

Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2005). The access times and fares are collected from the following website (http://transit.yahoo.co.jp/) and airlines' timetables.

Notes: Normal (the fully flexible fare), Peak (the fully flexible fare during peak season), Discount highest (the most expensive discount fare) and Lowest (the cheapest discount fare) on each route. Every air fare includes special fuel charge (JYE300), special security charge (JYE300) and airport charge (JYE100).

Table 4.6: Examples of transportation costs to selected destinations in Japan

Destination From Tokyo	Category	Train		Flight						
				Total journey time			Total cost of flight including direct cost for transportation to each airpot or station (USD)			
		Train Time (min)	Train Fare (USD)	Flight time (min)	Access & Egress time (min)	time (min)	Fully flexible fare	Access cost (direct)	Egress Cost (direct)	Total cost
Sapporo(SPK)	1	658	210	90	68	158	216	5.7	9.6	231
Fukuoka(FUK)	1	328	206	90	37	127	225	5.7	2.3	233
Osaka(OSA)	1	158	141	60	57	117	177	5.7	4.5	187
Hiroshima(HIJ)	2	254	171	80	75	155	246	5.7	12	264
Akita(AXT)	4	234	155	60	82	142	196	5.7	8.2	210
Aomori(AOJ)	4	248	156	70	67	137	242	5.7	5.2	253
Okayama(OKJ)	4	222	164	75	72	147	237	5.7	6.8	250
Yamagata(GAJ)	5	189	102	55	78	133	145	5.7	6.5	157

Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2005). The access times and fares are collected from the following website (http://transit.yahoo.co.jp/) and airlines' timetables.

Notes: All times and costs are computed from Tokyo station to the main station of each city. For example, in case of air transportation, the access time and fares are calculated from Tokyo station to Haneda airport and from the airport to the main station of the destination. Every air fare includes special fuel charge (JYE300), special security charge (JYE300) and airport charge (JYE100).

The time index of 0.73 on the Tokyo-Hiroshima route means that a passenger can arrive by air in Hiroshima from Tokyo about 100 minutes earlier (27%) than by train, assuming the flight was not seriously delayed. The fare index of Hiroshima shows that the lowest discount air fare (0.83) is fixed at almost 57% of the normal fare (1.44) and 55% of the peak fare (1.51). The lowest air fare (0.83) is 17% cheaper than the HSR train (1.00) from Tokyo (refer to Table 4.5).

This means that fully flexible air fares are about 50 % more expensive than JR. However some of the discount fares are cheaper than JR from Tokyo. The discount air fare index is lower than JR on Hiroshima routes. The highest discount fare index is 0.99. This fare is available the day before departure during the off peak season on this route.

This relationship between the fare index and the time index affects passengers' choice of mode. Those routes, such as the ones to Hiroshima and Okayama, which provide a better discount fare index, have experienced an increase in passengers and load factors. The market has been more responsive to the discount fares where the air time index is less than 1 to the train.

Table 4.7: Examples of Time and Fare indices of the domestic routes departing from Tokyo

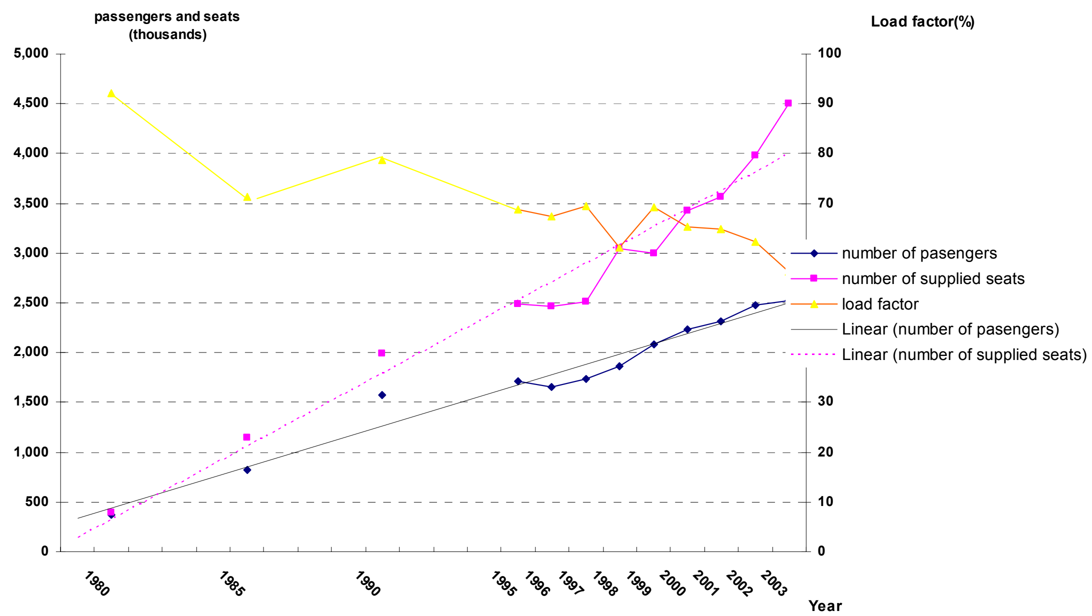
	Category	Fare (USD)				Time index	Fare index		
	Passenger Volume (per day)	Traffic Mode	Discount (USD)	Discount High (USD)	Fully Flex (USD)		Discount (lowest)	Discount (highest)	Fully Flex
Tokyo-Fukuoka (1174.9km)	1 22,632	Air Train	101.5 205.5	217.7	288,7 205.5	0.48	0.8	1.09	1.48
Tokyo-Osaka (552.6km)	1 16,475	Air Train	88.6 129.6	134.7	176.2 129.6	0.93	1.36	1.50	1.37
Tokyo-Hiroshima (894.2km)	2 6,927	Air Train	120.8 171.1	153.1	245.4 171.1	0.73	0.83	1.44	1.55
Tokyo-Okayama (732,9km)	4 3,068	Air Train	97.8 164.1	125.5	240.8 164.1	0.85	0.73	0.88	1.55
Tokyo- Nagoya (366km)		Train	84.5		84.5	Not available because of lack of air services			

Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2005). The access times and fares are collected from the following website (http://transit.yahoo.co.jp/) and airlines' timetables.

Notes: All times and costs are computed from Tokyo station to the main station of each city. For example, in case of air transportation, the access time and fares are calculated from Tokyo station to Haneda airport and from the airport to the main station of the destination. Every air fare includes special fuel charge (JYE300), special security charge (JYE300) and airport charge (JYE100). This exchange rate adopted the Representative Rates for Selected Currencies, which was reported in the exchange rate archives by month of the International Monetary Fund in June, 2005; USD 1 = JYE 108.4

Figure 4.5 shows that overcapacity exists on the Tokyo–Hiroshima route. This is caused by airlines' reactions to the runway extension at Hiroshima airport and the relaxation of the double / triple designation rules in 1996 and 1997. In addition, after deregulation in 2000, the average passenger load factor dropped significantly because of further oversupply. However, demand in this Tokyo-Hiroshima market is slightly but steadily increasing. The Tokyo-Hiroshima route has been one of the strongest air transport markets in Japan when compared with other transport modes. Airlines have used large-scale aircraft on all the flights in order to fulfil the specific demands of business travellers, even though it has resulted in relatively low load factors.

Figure 4.5: Supply and Demand on the Tokyo-Hiroshima route (1980 - 2003)



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1980-2003)

The same situation is found on the category 4 Tokyo-Okayama route (733 kms, Time index: 0.8, Lowest fare index: 0.73). Passenger volume has been increasing by about 17.3% per year since 2000.

Several category 4 air routes however have been diminished by HSR. Traffic on the Tokyo-Akita route (663 kms, Time index: 0.74, Lowest fare index: 0.8) increased by 8-9% in 2000 and 2001. However, it dropped by 3% in 2003 because the lowest discount fare was increased by 15.7%.

The Tokyo-Yamagata route (360 kms) experienced a decrease in traffic of 37.4% in 2000 and 22.7% in 2001 because the Tohoku Shinkansen line opened. Traffic recovered in 2003 because of the low discount air fare, but the lowest fare index was raised again in 2005. The difference between the non-restricted air fare and the discount air fare became very small or non-existent, when airlines recognised and decided to stop competing on these routes even after deregulation.

The most competitive route is Tokyo-Osaka (553 kms, Time index: 0.93, fare index: 1.37, Category 1), which has experienced increased demand of 14.4% per year on average since 1997. Air Transport demand is still increasing even though the air fare index is not so low as the result of the strong economic activity of the two cities. In this important business market, the airlines and JR have focused on speed and frequency. The Tokyo- Osaka route is an important revenue generator for both the airlines and JR. For example, the revenue of Tokaido Shinkansen services (JYE 914 billions) accounted for 84 % of total rail revenue in 2000. JR central has to charge fares 20% higher than they should be because of the high repayments on the long term debts imposed by the Government in 1987 when the former Japanese National Railways (JNR) was privatised (Knutton, 2001). JR central and JR east, which serve the Tokyo-Osaka Shinkansen route, have been increasing operating revenue and recorded their highest level of turnover in 2006.

4.6 Comparison of French and Japanese Experience

The experience of air-rail competition in the European market has been different to that of Japan.

In this section, several competitive domestic routes in France are compared with the Japanese routes. The French domestic market is one of the toughest regions for low cost carriers (LCC) in the EU. The HSR network has been widely developed in France with a network length of 1,400 km and 1.47m/sqkm of line density (see Table 4.2). Table 4.8 gives examples of Time and Fare indices of French routes which are computed using data for April 2004. In France, the routes with a Time index of about 0.5 had a LCC operating with the traffic volumes increasing as a result of the cheaper fares (Fare index : 0.45-1.79), even though the Fare indices of Air France were relatively high; 1.8-2.82. Competition between HSR and LCC has been experienced in markets where distance is more than 700kms and the Time index is less than 0.5. Because of a lack of slots at Paris airports, LCC are concentrating on the stronger markets for air transport and are focusing on more profitable routes including international routes from Paris, where the "Time index" is less than 0.5, in order to best utilise available slots.

Table 4.8: Example of Time index and Fare index on the domestic routes departing from Paris

	Air Passenger Volume Per day	Carriers	Time Index	Fare index				
				5 weeks before	4 weeks before	3 weeks before	2 weeks before	1week before
Paris-Nice (698km)	8,428	AF	0.49	2.02	2.02	2.82	1.75	2.33
		EZY	0.50	1.34	1.34	1.35	0.95	1.34
		TGV	1.00	1,00	1.00	1.00	1.00	1.00
Paris-Toulouse (608km)	8,034	AF	0.48	0.39	1.80	2.33	2.45	2.76
		EZY	0.55	0.45	1.70	1.79	1.64	1.64
		TGV	1.00	1.00	1.00	1.00	1.00	1.00
Paris-Marseille (657km)	5,601	AF	0.89	0.73	2.61	2.50	2.50	2.50
		TGV	1.00	1.00	1.00	1.00	1.00	1.00
Paris-Lyon (414km)	1,746	AF	1.48	1.22	2.13	2.63	2.75	3.68
		TGV	1.00	1.00	1.00	1.00	1.00	1.00

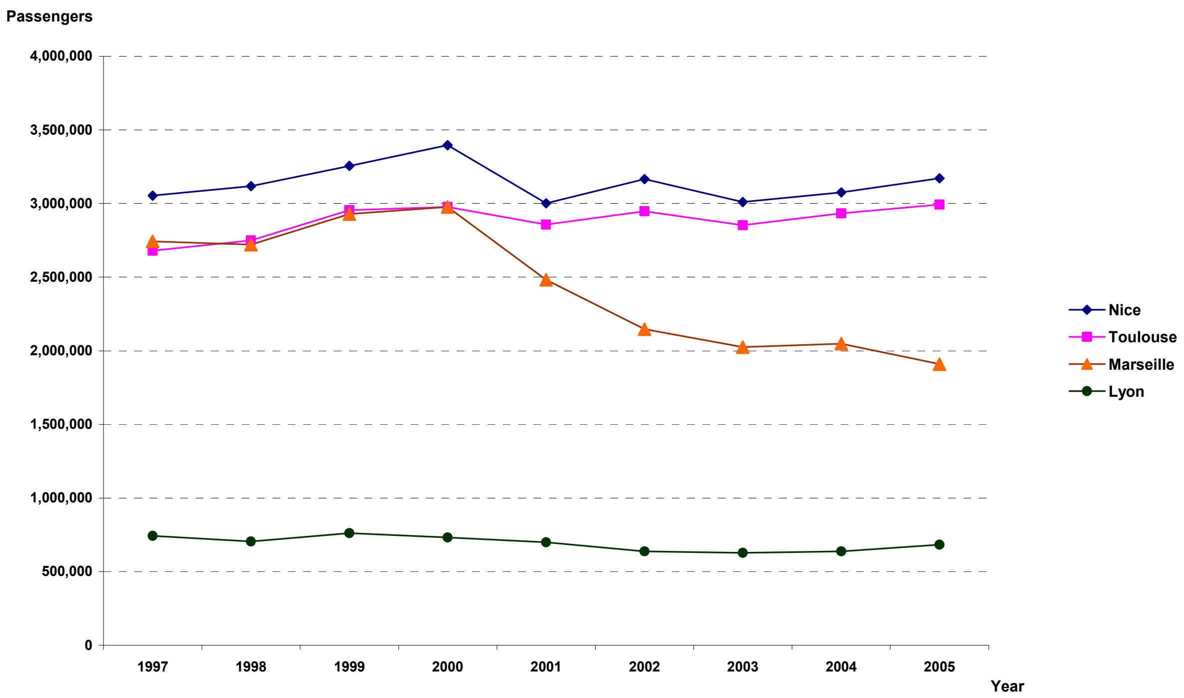
Source: Trafic Des Principales Relations Intérieures De Metropole Année 2004. The access times and fares are collected from the following website (http://www.aeroportsdeparis.fr/ADP/rn-GB/passengers) and the presentation study by Mr. Ralph Anker in 2004.

Notes: The exchange rates used adopted the “Representative Rates for Selected Currencies”, which was reported in the exchange rate archives by month of the International Monetary Fund in April, 2004; USD 1 = Euro 1.23

On the Paris-Lyon (414 kms) route, air traffic has decreased year on year; especially after the TGV Mediterranean route to Marseille opened in 2001. Time index of air transport on the routes was 1.48 with fare indices varying from 1.22 to 3.68 in 2004.

On the Paris-Marseille route (657kms, Time index: 0.89), the air traffic share dropped from 45-55% to 35-45 % as a result of the introduction of high speed rail services (Park and Ha, 2006). The air traffic volume was 2,975,150 in 2000 which decreased by 16.6% in 2001 after the TGV service commenced. After easyJet entered the route in July 2003, the number of passengers carried in 2004 increased by 1.2 % compared to a fall of 6% in 2003. The fare index of Air France ranged from 0.73 to 2.61 in 2004, which is relatively lower than on other routes because of the low TGV fare. EasyJet stopped operating the route in from March 2005, resulting in traffic dropping by 7% in 2005 (see Figure 4.6).

Figure 4.6: Air transport demand on several French domestic routes



SourceAuthor based on data from Trafic Des Principles Relations Intérieures De Metropole from 1997 to 2005

Interestingly, Air France's fares on these routes are almost the same as the Japanese network carriers. For example, on the Tokyo-Hiroshima route (894 kms, Time index: 0.73), fares ranged from USD120.9 to USD245.5 (Fare index: 0.73–1.55), while Air France's fares on the Paris- Nice route (698 kms, Time index: 0.49) are from USD 132 to USD 333.3 (Fare index: 1.75 to 2.33). These high fare indices of Air France in comparison with the Japanese fare indices show that the TGV offers much cheaper fares than Japan Railways.

Air passenger volume has increased as a result of the high frequencies and low fares (Fare index is lower than 1.35) in the French market. As the TGV can offer low fares, airlines need to compete in the market, where the Time index is less than 0.5 using varieties of lower fares (see Table 4.8). For this reason, LCCs have left the markets like Paris-Marseille and Paris-Lyon aside (Time index: more than 0.5, Fare index: more than 1.5) in order to concentrate their assets on more potential routes, where they can stimulate demand more profitably. The above demonstrates one of the reasons why the French domestic market from Paris has been relatively untouched by European LCCs.

4.7 Summary and discussion

The French domestic market, where the HSR network has been expanded, has been one of vigorous competition for LCCs. Figure 4.7 shows that the competitive market segment in France differs from that of Japan. LCCs have been operating in the specific segment of more than 700 km distance, where the time index is less than 0.5. The relatively lower fare of the TGV is a more significant demand influencing factor rather than the speed. If its speed could be improved further by technical innovation, this market could become even more challenging for air transport. Furthermore, low fare high speed rail is now increasingly provided on mixed traffic lines on several routes, as it is recognised that the increased flexibility yields more advantage rather than through expensive construction and maintenance costs (Briginshaw, 2005).

In Japan, competition has been experienced in the markets where the Time index is 0.4-0.9 (550-1,000kms) and Fare index is 0.8-1.5, in particular, on the Tokyo-Osaka route (552.6 kms, Time index: 0.93). In 2003, the number of Nozomi departures increased from 75 to 135 in order to offer more frequency and speed. Market growth has been delivered by competition between the high-speed train and airlines on specific routes. However, fare competition is not so prominent because of the absence of LCCs in the Japanese market. The Tokyo routes are important cash cows for both airlines and JR. Discounted fares have stimulated demand on several routes, such as Tokyo-Hiroshima.

Competition will enter into another era soon. Two airports (Kobe and Kitakyushu) were newly opened in 2006. Kobe and Kitakyushu are major cities, which are served by Shinkansen rail services. As a result, competition will be intensified more in the range of 550 kms-1,000 kms.

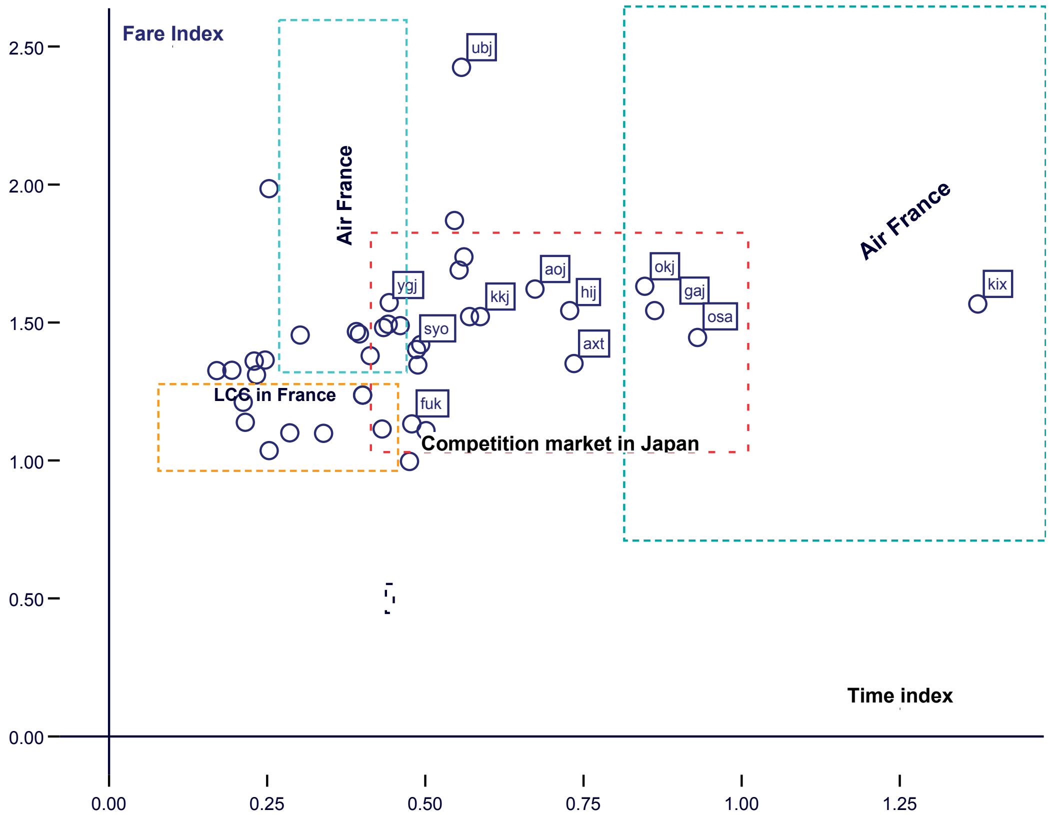
The Time index has changed dramatically, not only by the speed of the trains but also by the development of the "Access and egress service"; improvements of facilities and surface transportation to airports and stations,[14] and advanced reservation and payment systems using mobile phones and IC cards[15]. The development and management of the "Access and egress service" is becoming more of an important issue and the key to

[14] It takes only 16 min from the central area in Kobe to Kobe airport by urban automated guiding transit system.

[15] "Express reservation" Services of Tokaido high speed rail provides IT technology service, which enables passengers to directly arrange or change their reservations online via PC or web browser-equipped mobile telephone as often as they like.

success for any kind of transportation in terms of managing security, especially after the terrorism plot in the UK in 2006.

Figure 4.7: The competitive market segment between air transport and HSR in Japan



Notes:1: Each label shows the destination from Tokyo : fuk (Fukuoka), osa (Osaka) in category 1 , kix (Kansai), hij (Hiroshima) in category 2, axt (Akita), aoj (Aomori), okj (Okayama), ubj (Yamaguchiube) in category 4, gaj (Yamagata), ygj (Yonago), syo (Syonai), kkj (Kitakyushu) in category 5.

Notes 2: Each circle reflects a specific route. The areas which show the situation of Air France in the French domestic market differ from that of the Japanese domestic market.

Fare competition in Japan is not as severe as in France yet. Competition has focused more on “Utility” rather than “Cost” in Japan. Customers’ reactions are very sensitive to this balance with increased competition. Even in the Japanese market, some routes like those to Hiroshima or Okayama have experienced higher air transport demand as a result of low discount fares.

In 2009, the number of Haneda airport slots will be increased to 1,114 a day, which will be about 40% more than in 2005 (782 slots a day). Kyushu Shinkansen will be connected from Hakata (Fukuoka) to Shin-Yatsushiro (123kms) to enable son-stop operation from Fukuoka to Kagoshima by high-speed train in 2010. In addition, the Tohoku Shinkansen line will be extended from Hachinohe to Shin-Aomori (81 kms) in 2010 and the Hokkaido Shinkansen is planned to be extended from Shin-Aomori to Shin-Hakodate (149kms) on the island of Hokkaido via an underwater tunnel in 2015. The total budget of the new Shinkansen projects in 2005 was set at JYE 220 billion including 32% in Government grants, while the remaining 68% is covered by local government and JR companies (Railway Gazette International, 2005). Huge investments will be injected into both infrastructure and high technology services, including carriage performance development. Meanwhile, all of these destinations involve categories 4 or 5 airports, which have experienced decreasing demand after deregulation. These projects will result in large changes to the Time index in the Tokyo route market. It is very difficult to develop the market for both air transport and HSR without very low fares, which stimulate demand. In the Tokyo market, competition will be experienced with more equilibrium between “Utility” and “Cost” in the Customers’ Valuation on several high demand routes.

The study in this chapter has demonstrated how low fares have stimulated air transport demand on several routes like Hiroshima and Okayama as the result of competition between air and HSR in Japan. However, fares are relativily expensive on the most of routes serving Tokyo The trade-off of these variables, “Utility” and “Cost” for passengers, will be needed more if competition is stronger as “Cost” competition is getting harder. It is crucial to improve synergies between air transport and HSR on routes which have been experiencing stagnation of demand especially in route categories 4 and 5, in order to develop demand through low fares and better access services. The absence of very low fares, which increase demand is constraining the market and preventing the development of air transport as witnessed in other parts of the world. Comprehensive measures in respect of both air transport and HSR are needed to ensure the huge investments in both airports and HSR are effective. Speed is high enough, but low fares are needed in order to sustain a more competitive market in Japan.

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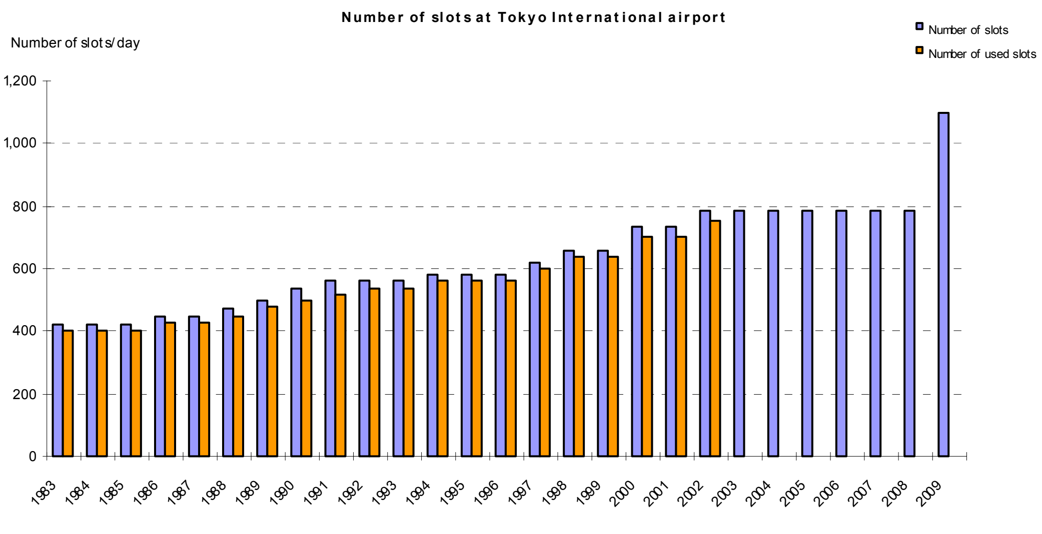
Chapter 5: The slot allocation system at Tokyo international airport

"There is a certain amount that ANA can do on its own, but there is a certain amount that ANA can't do" (All Nippon Airways Former CEO Yoji Ohashi)[16]

5.1 Introduction

Facilities at Tokyo international airport (Haneda) have been developed with capacity responding to the rapid growth in demand for air transport resulting from the economic development of Japan. New slots have been allocated to operators by the Government at each time Haneda airport was extended and its capacity increased. In 2000, the number of daily slots was 660. Because of the delay in the construction of the Narita international airport (Narita) and the absence of secondary airports in the Tokyo area, slots at Haneda airport have never satisfied the growing demand in the domestic market of Japan. The shortage of slots at Haneda airport has been recognised as a bottleneck for the economic revitalisation not only of the Tokyo area itself but also of all the regional parts of Japan, especially during and after the recession.

Figure 5.1: Number of slots at Haneda airport



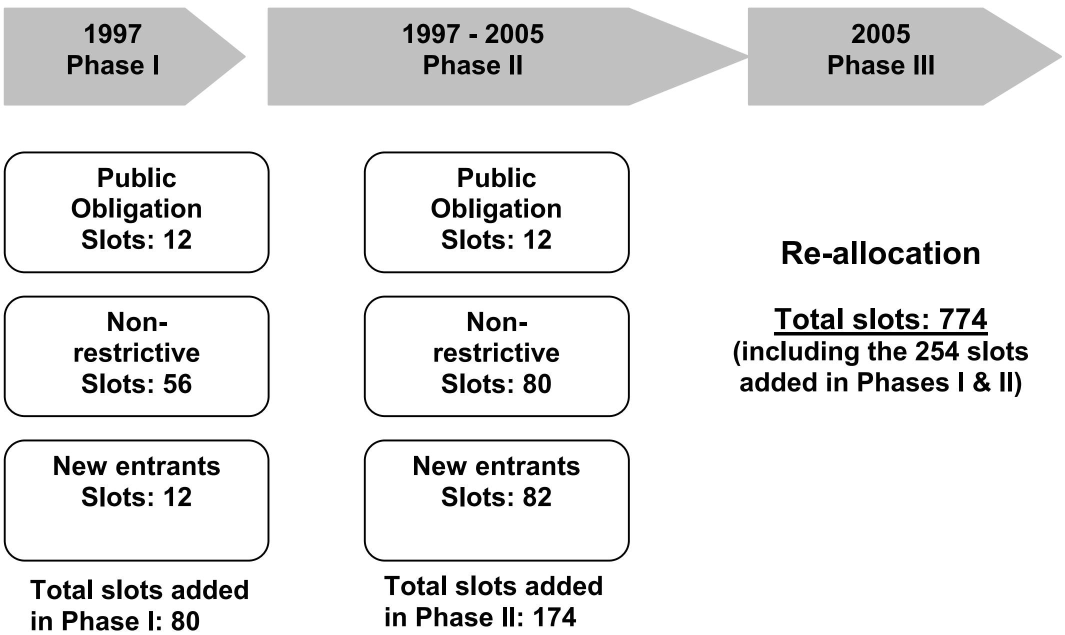
Source: Ministry of Land, Infrastructure and Transport, White paper (2004)

[16] Airline Business, Volume 20 Number 9 p.36

This chapter aims to investigate the policy and process of the slot allocation system at Haneda airport by focusing on the policy making procedures and implementation process.

Between 1997 and 2003 the number of slots at Haneda airport was expanded five times. The slot allocation system used during this period was segmented into three phases. The first slot allocation system, "Phase I" was started with the additional slots of the new C runway in July, 1997. The second allocation, "Phase II" resulted from the additional slots of the new B runway in 2000. The third one, "Phase III" was introduced between 2005 and 2006.

Figure 5.2: The slot allocation system at Haneda airport



These slot allocation policies were implemented according to the policy and guidelines devised following meetings not only with experts and business leaders in various fields but also with airlines staff. During these meetings, airlines had several opportunities to express their opinions and ideas to the Government for the slot allocation policy. This slot allocation system at Haneda airport is a unique system compared to other regions not only because of its characteristic market but also for its slot allocation policy and implementation methods.

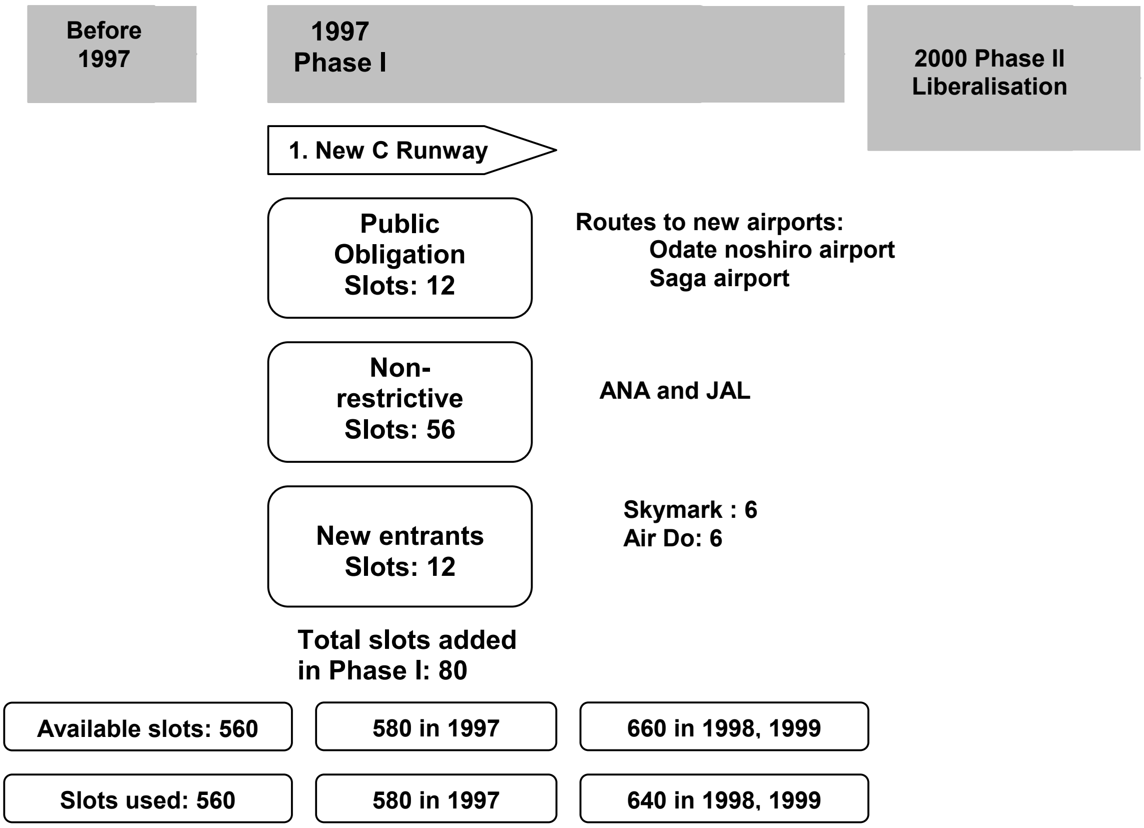
This slot allocation policy, which started in 1997, is comprehensively called "The slot allocation system at Haneda airport" in this thesis in order to distinguish it from the slot allocation policy before liberalisation. This slot allocation system is discussed in detail in the following sections.

5.2 Slot allocation in 1997 - Phase I

Prior to liberalisation and the vast revision of the air law in 2000, 80 slots were added by the new C runway in July 1997. This meant the beginning of a new age of slot allocation policy at Haneda airport. The objectives were to increase transparency and fairness in promoting more competition in the Japanese domestic market. These 80 slots were categorised into three kinds of slots, "Public Obligation" slots, "New entrants" slots and "Non-restrictive" slots.

Twelve "Public Obligation" slots were secured for routes to two new airports (Odate and Saga) and also for routes which only had one return flight a day, in order to improve access. In addition, twelve slots were provided to each new entrant as "New Entrant Slots". Such slots were allocated to two new airlines, which had announced their intention to start operations in 1998 (Skymark and Air Do). Unused new entrant slots were provisionally allowed to be used by incumbent airlines until a new entrant started its operations. Fifty-six "Non-restrictive" slots were divided among the incumbent airlines (JAL, ANA, and JAS). Thus, some of the slots controlled by this slot allocation policy consider the destination and operators in order to promote competition and stimulate low demand markets (see Figure 3.3).

Figure 5.3: Slot allocation in 1997- Phase I



5.3 Slot allocation in 2000; the fundamental circular of the Haneda slot allocation system in 2000 - Phase II

With liberalisation of Japanese domestic air transport in 2000, the new slot allocation policy at Haneda airport was promulgated in order to respond to the significantly growing demand of the Tokyo routes as a result of the increased slot availability at Haneda airport in Phase I. Several meetings and debates took place prior to the implementation of the policy to resolve these slot allocation matters. The main topics of the discussions are detailed below.

The fundamental points of these policies relating to the slot allocation rules at the congested airports were discussed in the Council of the Transportation Policy and Air Transport Meeting Report of April, 1998. This suggested that the slot allocation rules should be objective with a transparent policy implemented for the sake of promoting consumers' convenience and efficient slot allocation for airlines.

Table 5.1: Main meetings for policy making of the slot allocation system at congested airports prior to 2000 (Phase II)

April, 1998	**Council of the Transportation Policy and Air Transport Meeting Report**
November, 1998	**Slot allocation system study meeting report**
February, 2000	**Slot allocation system at congested airports meeting report**

The Slot allocation system study meeting report of November, 1998 discussed policies and procedures to recall and re-allocate slots at congested airports. The following policies were combined for recalling slots: (1) Fixed ratio recall rule (5–10% of slots recalled from incumbent airlines); (2) "Use it or lose it" rule, based on criteria related to the efficient usage of slots by airlines. For re-allocating slots, it was decided to give priority to new entrant airlines and routes in order to promote the development of local air services. The key points of discussion in these meetings were "the promotion of competition", "the promotion of the development of local air networks" and "the evaluation of incumbent airlines" (cf. infra). Thus, these policies became fundamental guidelines for "the slot allocation system at congested airports meeting report in February 2000".

This Congested airports slots allocation system meeting report of February 2000 for the first time defined "New entrants" as (1) airlines operating less than 12 slots per day at Haneda airport or (2) a start-up airline using Haneda airport. It also stated that 18 slots were supposed to be saved for start-up airlines. As a result of these discussions, the key policy was established to allocate 114 additional slots as a result of the new B runway at Haneda airport in 2000. It was legislated in the air law of 2000 that this policy should be reviewed every five years until 2009, when the number of slots at Haneda airport will be extensively increased.

5.4 The Haneda additional slots fundamental circular of 2000

The aforementioned policies were implemented by the so-called "Haneda additional slots fundamental circular". As one of the outcomes of liberalisation, it was assumed to have a large impact on the domestic air transport market in Japan.

This circular consisted of four fundamental Policy principles:

1 The promotion of competition
2 The improvement of consumers' convenience by the formation of a diverse air transport network
3 Slot allocation based on the results of the evaluation of each incumbent airline
4 The non-admission of small aircraft (less than 60 seats) except during early morning and late evening (arrival during 23:00-08:30 and departure during 20:30-23:00).

Categories of slots in this circular were differently named from the former circular of 1997. However, the concepts of the slot allocation policy were almost the same as in 1997 with three kinds of slots categories: New entrant slots, Public obligation slots and Non-restrictive slots.

a) New entrant slots: promotion of competition

30 slots were allocated to new entrants in order to promote competition and 18 slots were saved for future new entrants. The new entrants were defined here as airlines which had less than 12 slot operations per day.

b) Public obligation slots: the expansion of the local network

Two slots were secured for routes to newly opened airports with the aim of expanding the local network. There were no restrictions on who could claim the slots as any airline could apply. These two slots were one for the "New Monbetsu airport", which opened in July 1999, and another for "Noto airport", which opened in July 2003. Both of them have been operated by the ANA group as a result.

c) Incumbent airline slots

The other 80 slots were allocated to the three incumbent airlines (JAL, ANA and JAS) according to the standard evaluation, which is based on: the improvement of consumer convenience, the promotion of efficient airline management, the promotion of the efficient usage of slots and other criteria such as the business performance of incumbent airlines. This standard evaluation aimed to provide transparent and fair slot allocation and has mainly three objectives to evaluate by numerical values (see Table 5.2).

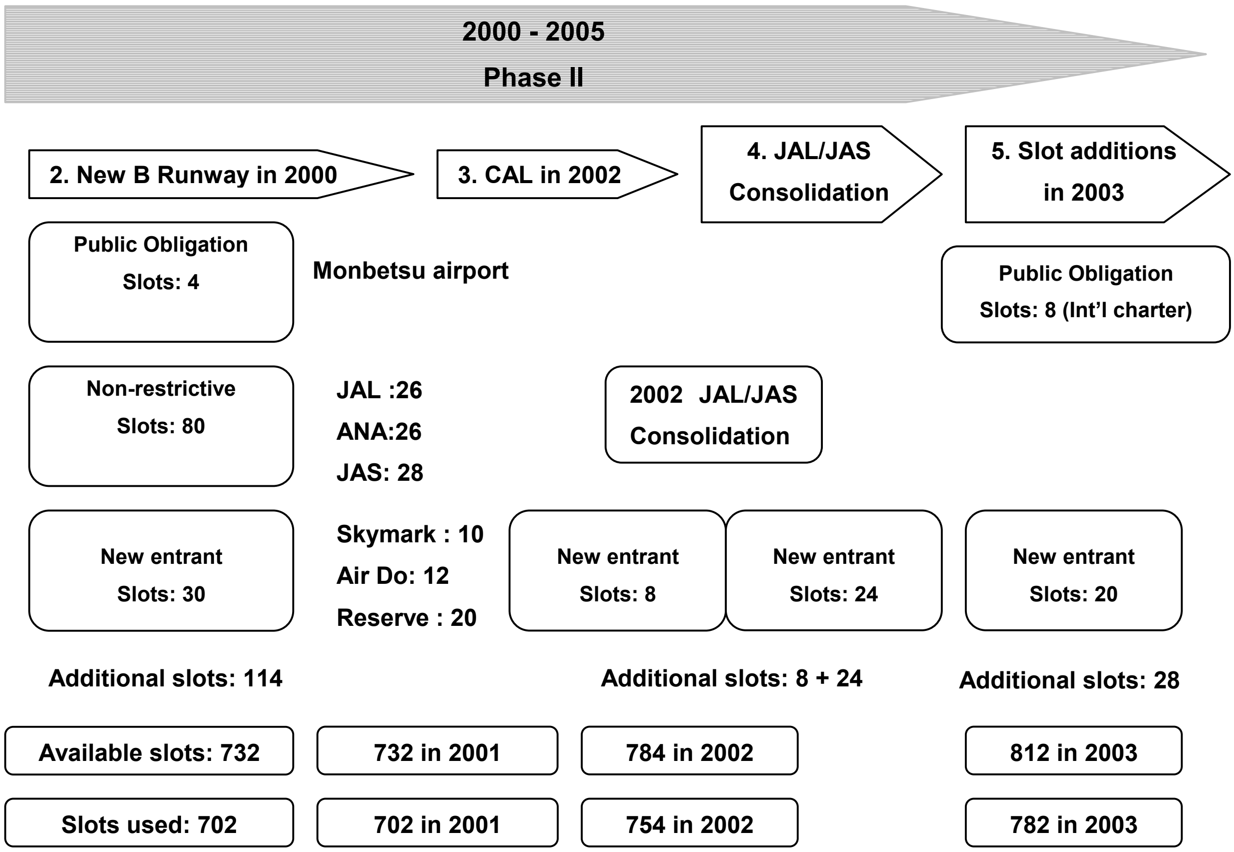
Table 5.2: The evaluation objectives and criteria

	Objectives	Examples of Criteria
1	**The improvement of consumers' convenience**	
	Lower fares	Revenue per RPK has been decreased in the past five years
	Safety	No fatal accident in the past five years
	Local routes network	Frequency on the routes (traffic: less than 0.1 million) is more than average or number of frequencies on the routes has increased in the past five years. The share of local routes network is more than 50% of the total of the Tokyo routes.
2	**Effective airline management**	Operation cost per Passenger kilometre decreased in the past five years. Operation revenue per employee increased in the past five years.
3	**Effective usage of slots at Haneda airport**	Number of passengers carried per slot increased in the past five years
4	**Others**	No administrative sanction in the past five years.

5.5 Additional slot allocation: Competition promotion slots of 2002

The fundamental policy of 2000 was succeeded by a new policy in 2002, which promoted competition in order to encourage the activities of new entrants and developing airlines (Skymark, Air Do and Skynetasia). An additional 24 slots were allocated to these airlines for their route expansion. An extra 34 slots were allocated to new entrants or other developing airlines as New entrant slots. All of these slots not used by new entrants and developing airlines were allowed to be allocated to the incumbent airlines (JAL and ANA group). Under this policy, the developing airlines were named “Specific incumbent airlines”, including Skymark, Air Do and Skynetasia, because these airlines already had several years operating experience, and thus could not be called “new entrants” anymore. They are called “Developing airlines” in this study.

Figure 5.4: Slot allocation Phase II



The results of the slot allocation in Phases I and II are summarised in Figure 5.5.

During Phases I and II, the additional slots were allocated five times:

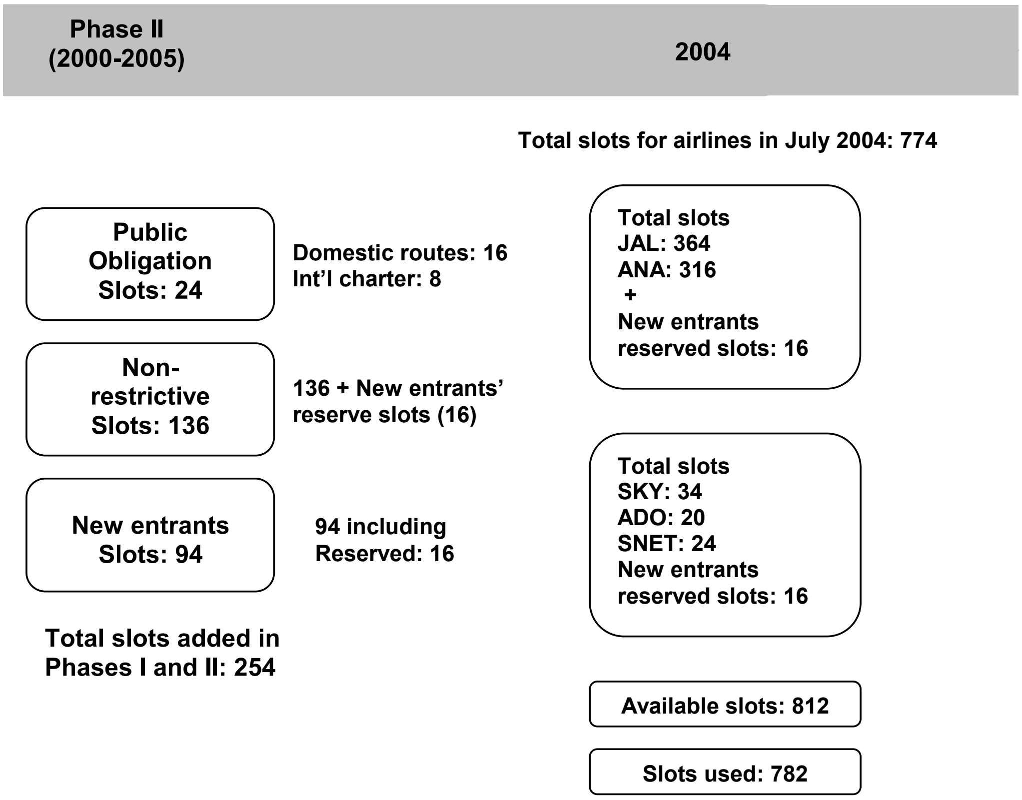
1. 80 slots as a result of the new C runway operation in 1997. 85% of the slots were allocated to incumbent airlines and 15% to new entrants.
2. 114 slots as a result of the new B runway operation in 2000. Following the 2nd allocation in 2000 according to the "Haneda slots fundamental circular of 2000", 74% of the additional slots were provided to incumbent airlines (JAL, ANA and JAS) and 26% to new entrants (Skymark and Air do). Although new entrants had an opportunity to use 40 slots as a result, these new entrants (Skymark and Air do) used only 22 slots (Skymark: 10, Air do: 12); the other 20 slots were pooled and used by incumbent airlines.
3. 8 slots as a result of the destination change of China Airlines from Haneda to Narita in 2000. These 8 slots, so-called "Competition promotion slots", were

allocated to new entrants. However, these slots also were pooled and used by incumbent airlines, because new entrants didn't have enough aircraft to utilise them.

4. 24 slots as a result of Japan Airlines and Japan Air System's consolidation in 2002. These slots were allocated to new entrants.
5. 28 slots as a result of the improvement of air navigation at Haneda airport in 2003. 20 slots were allocated to new entrants, while 8 slots were provided to international charter flights.

Of the 44 slots allocated to new entrants in 2002 and 2003, only half of them are used by these airlines; the other 22 slots were earmarked as 'reserve' and eventually used by incumbent airlines in 2003. As a result of Phases I and II, 254 additional slots were allocated including 24 Public Obligation Slots (New airport routes: 16, International charter flights: 8), 136 Non-restrictive Slots for incumbent airlines and 94 New entrants Slots (Skymark: 34, Air do: 20, Skynetasia: 24 and Reserve: 16). In July 2004, the total number of slots used for domestic flights were 774 including 686 by incumbents and 78 by new entrants (see Figure 5.5).

Figure 5.5: Summary of the results of Phases I and II



5.6 Slot allocation in 2005; the Haneda fundamental policy circular, Phase III

The review of slot allocation at Haneda airport proceeded according to the legislation[17], eight years after the first slot allocation. In 2009, the number of slots at Haneda airport will be increased to 1,114 a day, which will be about 40% more than in 2005 (782 slots a day). The number of slots is currently limited and will cause a shortage until 2009. This issue causes an obstruction to development not only for air transport but also the economic market in Japan as a whole. Six meetings were held in 2004 to discuss the utilisation of the current 782 daily slots at Haneda airport. As a result of these discussions "The Haneda fundamental policy circular" was established.

Table 5.3: Main meetings for the slot allocation system in 2005

Meeting	Date	Topics & Agenda

[17] According to air law, the slot allocation procedure needed to be reviewed every 5 years.

1	**20 Feb 2004**	**Present situation and issues in Airline industry in Japan**
2	**25 Mar 2004**	**Hearing (presentations by airlines)**
3	**14 May 2004**	**Discussion, Hearing**
4	**18 Jun 2004**	**Discussion, Hearing**
5	**6 Aug 2004**	**Report draft, Discussion**
6	**7 Sep 2004**	**Report draft**

Japanese carriers had the opportunity to present their opinions and ideas for slot allocation during a series of hearings. This resulted from the recognition by the Government that slots have a profound impact on airlines' business activities. It was significant that the terms "New entrants" and "Slots" were defined in the official documents for the first time in this circular. The definitions are as follows.

a) "New entrants" are defined as:

i) Airlines which have less than 12 slots at Haneda airport

ii) Airlines which are going to apply for permission to operate at Haneda airport.[18]

b) "Incumbent airlines" are defined as airlines which are not new entrants.[19]

c) "Major airlines" are defined as the two big airline groups, JAL and ANA.

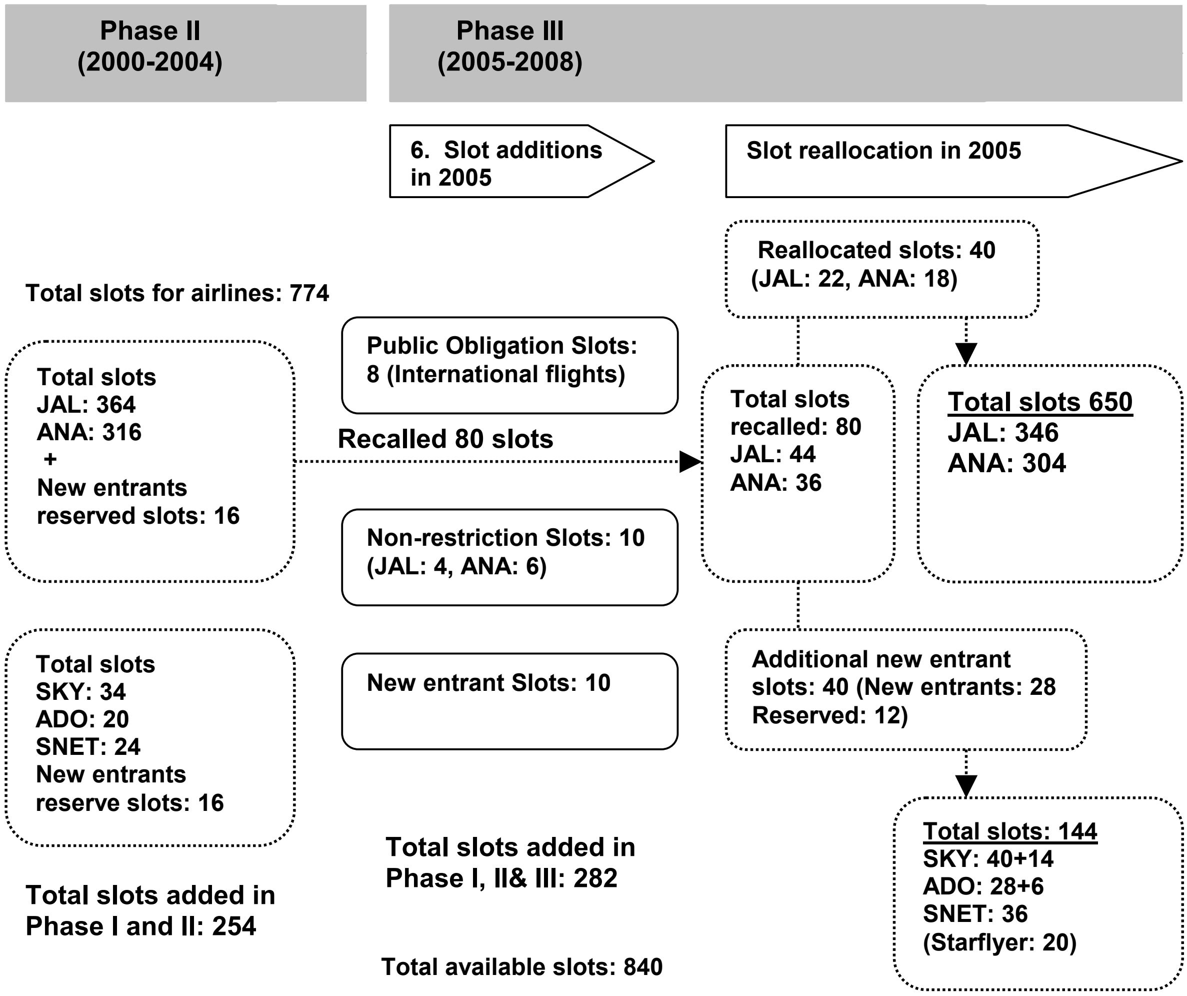
This Haneda fundamental policy circular's main aim was the promotion of competition and the expansion of local air services networks. It followed the main government policy of 1997.

80 slots (JAL: 44 slots, ANA: 36 slots) were taken from the total of 680 slots of these major two airlines at Haneda airport. 40 of the 80 slots were allocated to a new entrant (Starflyer) and developing airlines (Skymark, Air do and Skynetasia) as "Additional new entrant slots" and the other 40 slots were re-allocated to the two major carriers as "slots by airline evaluation" according to the same evaluation standard of 2000. As a result, 22 slots went to the JAL group and 18 to the ANA group. Thus, the total number of New entrant slots became 144, including an existing 104 slots in this category. 12 slots of the

[18] Starflyer requested an AOC in 2004 for starting operations in 2006.
[19] They include Skymark, Air Do and Skynetasia.

additional 40 slots were saved for future new entrants and designated as "Future new entrant" slots. A new start up airline, Starflyer acquired the right to use all these slots in 2005 (see Figure 5.6).

Figure 5.6: Slot allocation Phase III



5.7 Summary

The proportion of allocated slots for new entrants to the total number of slots increased from 2% in 1998 to 15% in 2005 during these slot allocations. Regarding the prospect to acquire slots for new entrants, they had enough opportunities to expand the routes. However, they failed to exercise the opportunity to utilise the allocated slots during the slot allocation process. It was evidenced that more than 48% of slots (the 20 of 42 allocated slots) for new entrants were reserved in 2000 and 14% in 2004 (see Table 5.4). As a result, the total number of slots for incumbent carriers (JAL, ANA) changed to 650 in 2005 from 552 in 1998 and 670 in 2004. Despite 40 slots being recalled by the reallocation in 2005, the reserve 20 New entrant slots enabled them to use 670 slots until 2006.

Table 5.4: Share of allocated slots for airlines

Phase		**Phase I**	**Phase II**		**Phase III**
Share of total allocated slots		**1998**	**2000**	**2004**	**2005**
Incumbent airlines	Allocated slots	98%	93%	88%	85%
	Used slots	98%	96%	89%	88%
New entrants	Allocated slots	2%	7%	12%	15%
	Used slots	2%	4%	11%	12%

Source: Author based on data from Ministry of Influstructure, Land and Transport (2005)

IATA states that as part of its fundamental role of the slot allocation framework as they manage regulatory affairs and policy matters on behalf of airline members by cooperating with many international regulatory bodies. They also mention that slot allocation is only required where there is insufficient airport capacity to meet demand and does not increase capacity, i.e. it is only a mechanism for distributing what is available.

Its fundamental policies are: (1) globally convertible, (2) market driven and aimed solely at the maximum effective use of airport capacity, (3) transparent fair and non-discriminatory, and (3) simple, practical and economically sustainable (IATA, 2000). The standards and procedures of slot allocations are specified in the Worldwide Scheduling Guidelines (WSG), which is developed jointly by airlines and airport coordinators to ensure the interests of both bodies are reflected in the standards. The principle is based on historic slots and WSG explains the exceptional cases as additional regulations by governments in the regions, such as the “new entrants provisions” in the EU.

The slot allocation system at Haneda airport belongs to this exceptional case under the promotion policy of competition in order to increase slots for new entrants and improve the local air services networks. The facts, that more than 11% (80 slots of 680) of the total network carriers' slots were taken and re-allocated by the Government was extremely exceptional. However, by 2006 network carriers were able to use 670 slots including pooled New entrant slots, while they lost only 10 slots (1%). Including additional slots, Skymark acquired 54 slots, Air Do 34 and Skynetasia 36 slots as a result.

In the following chapter 6, the study will explain how the Tokyo routes market has been affected by the slot allocation system at Haneda airport and how airlines have responded to the slot allocations. It also evaluate whether the objectives of these slot allocations at Haneda airport have been accomplished.

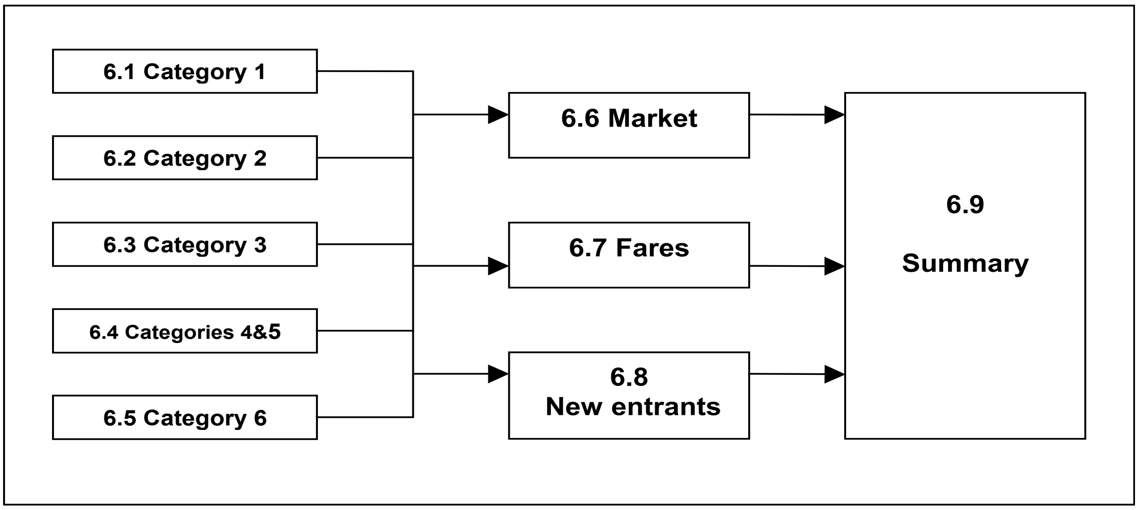
Chapter 6: Analysis of the impact of deregulation and the effects of the slot allocation system on the Tokyo routes market

In this chapter 6, the effects of the slot allocation system on individual routes and market categories of the Tokyo market as a result of deregulation are analysed in detail using several factors. The specific data matrices are listed in the following appendices.

Appendix J: Matrix of factors on the Tokyo routes by category in 1997
Appendix K: Matrix of factors on the Tokyo routes by category in 2000
Appendix L: Matrix of factors on the Tokyo routes by category in 2001
Appendix M: Matrix of factors on the Tokyo routes by category in 2003

First of all, the characteristics of each market including demographic and economic backgrounds during the period from 1997 to 2005 are analysed by category in sections 1 to 5. In section 6, the overall effects on the air transport market are demonstrated by category and the process of deregulation outlined in 1997, 2000, 2001, and 2003. How fares have been transformed is analysed in section 7 using data from 1999 to 2005. The markets where new entrants have operated are evaluated in section 8. The results of the effects of slot allocation and liberalisation are summarised in section 9 (see Figure 6.1).

Figure 6.1: The structure of chapter 6



6.1 Category 1 routes

6.1.1 Characteristics: the High demand market

All the routes in this category are ranked in the top busiest routes in the world. The features of this air transport market are as follows.

Table 6.1: The market characteristics; Average in 2000

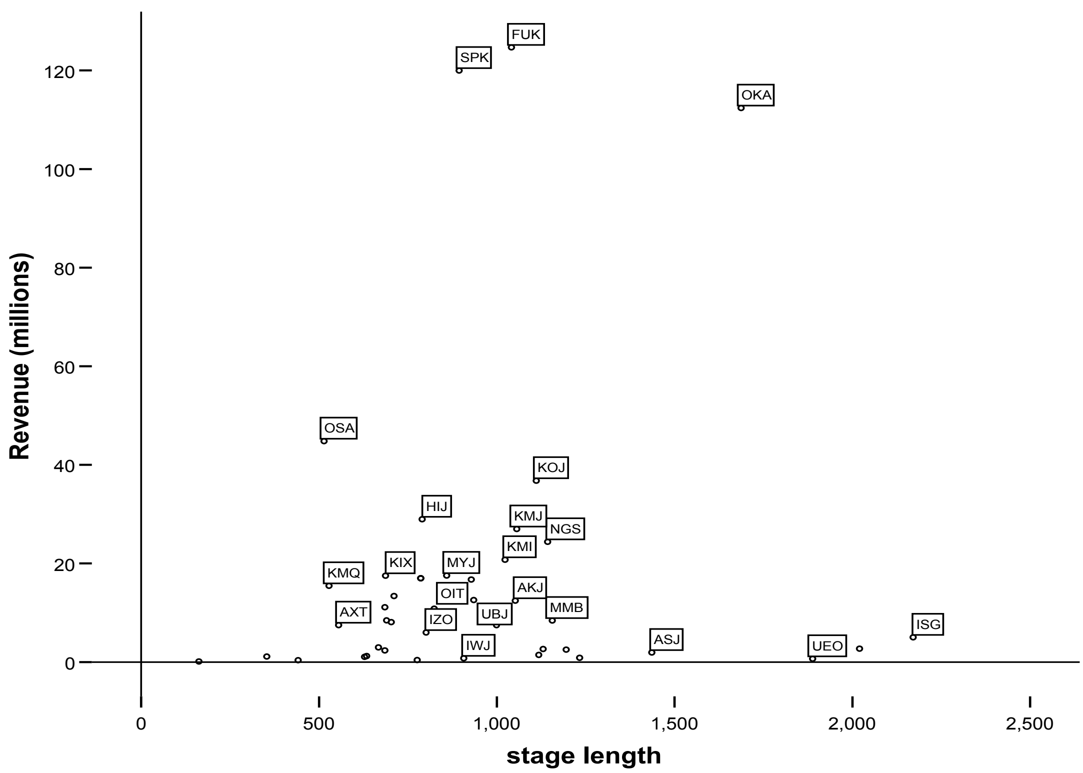
Routes from Tokyo to	Stage Length (km)	Number of departures per year (day)	Number of passengers per year	Average Passengers per flight	Average load factor
Sapporo	894	31,812 (87)	8,982,063	282	65%
Fukuoka	1,041	28,816 (79)	7,989,491	277	64%
Osaka	514	13,009 (36)	4,359,858	335	71%
Okinawa	1,687	13,062 (35)	3,745,444	287	72%
Average	1,034	21,675 (60)	6,269,214	295	68%

Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Notes: the numbers are calculated using the statistics records of JCAB from in 2000

These routes are the most profitable routes, characterised by high load factors and operated by large capacity aircraft at high frequency. For example, there are almost eighty take offs per day on the Tokyo-Sapporo and Tokyo-Fukuoka routes. All Japanese airlines have been vigorously focusing on this category 1 market. To fulfil high demand during peak periods on these routes, airlines have been operating large aircraft. Figure 6.2 shows revenue by route compared with the stage length of Japan Airlines in 2003. The top four routes in terms of revenue are all category 1 routes from Tokyo to Sapporo, Fukuoka, Okinawa and Osaka.

Figure 6.2: Japan Airlines' routes in 2003



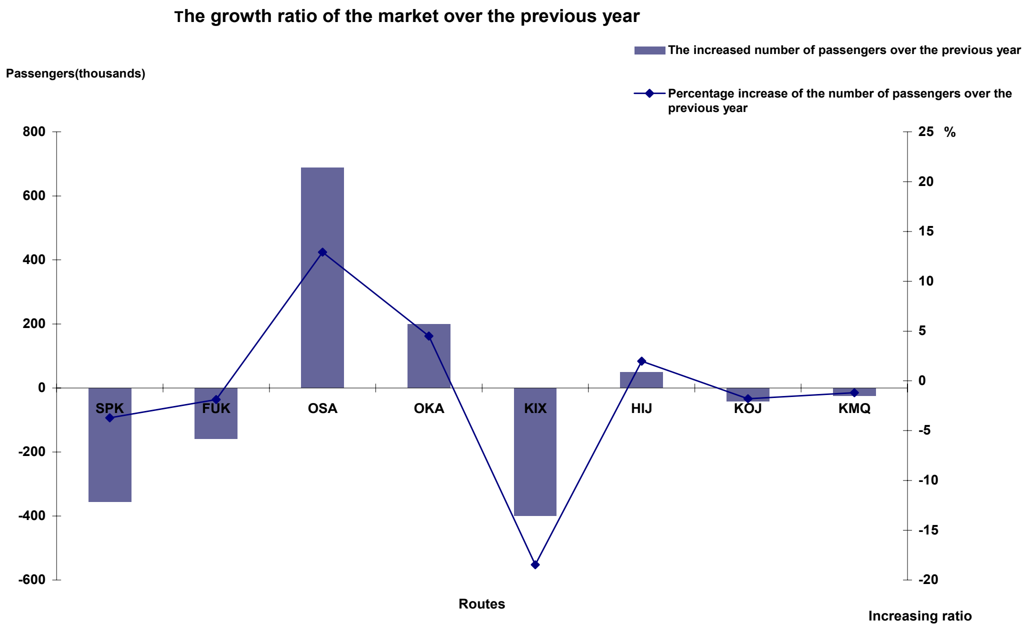
Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2003) and Fact sheets of Japan airlines in 2003

6.1.2 Market growth

The category 1 market has been driving the development of the air transport market in Japan as it has been the biggest and most profitable market. Especially, on Fukuoka and Sapporo routes, where new entrants (Skymark Airlines and Air Do) entered in 1998 and 1999, the expansion of the market was expected very much. However, traffic on these market routes did not grow but was saturated by overcapacity as a consequence.

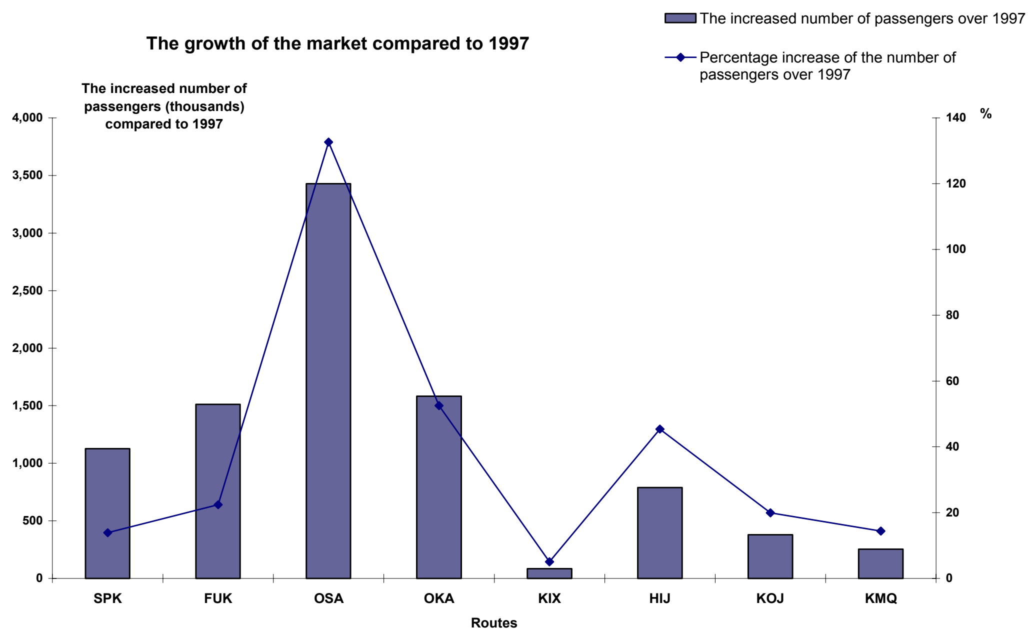
Figures 6.3 and 6.4 demonstrate the growth rates in this market from 1997 to 2003 in route categories 1 and 2. They evidence the prolonged market growth on the Fukuoka, Sapporo and Kansai routes. Only the Osaka route is dynamically indicating its activity, which has the possibility for development.

Figure 6.3: Air transport market growth over the previous year in route categories 1 and 2 in 2003



Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (from 1997 to 2003)

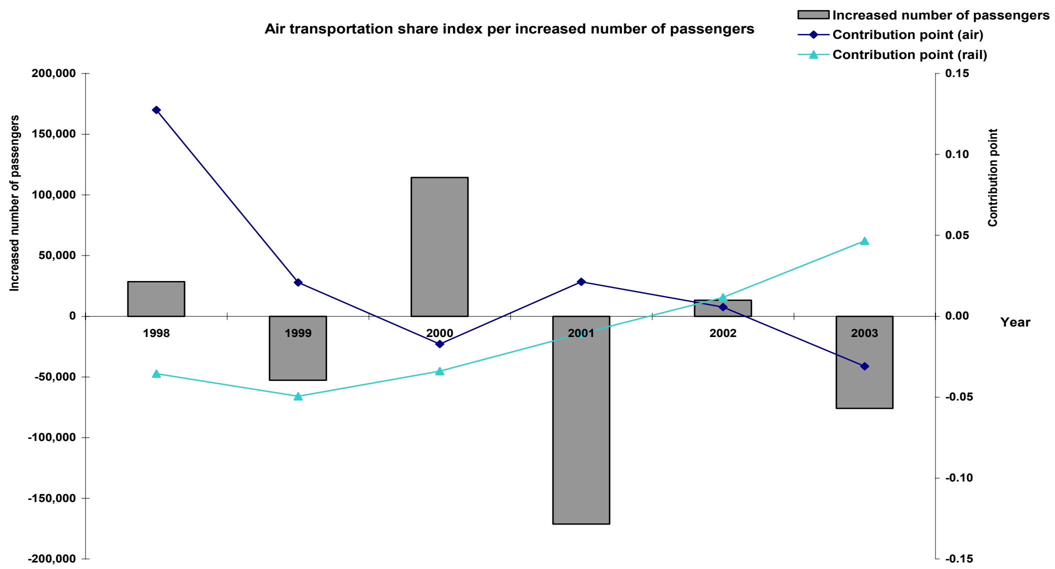
Figure 6.4: Air transport market growth over 1997 in route categories 1 and 2 in 2003



Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (from 1997 to 2003)

The category 1 market has the geographical advantage as Sapporo and Okinawa are located on the north and south large islands respectively, and are almost 1,000 kms away from Tokyo. The proportion accounted for by air transport stands at 97% in the modal choice of passengers from Hokkaido to Tokyo. The effects of the development of air transport on the local economies are enormous in this area. Figure 6.5 shows the increased total passenger movements from Hokkaido to other prefectures and the proportion that air transportation accounts for this increase. The ratios referred to here as "the market growth contribution" are computed by the increased percentage rate of each transport mode's passengers multiplied by each market share of the total number of passengers of a previous year. It shows how much air transportation plays in the growth of the total number of passengers.

Figure 6.5: Air transport market growth contribution to total passenger growth in the Hokkaido prefecture from 1998 to 2003



Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2003)

Note1: the total number of passengers means the total number of passengers who moved by all transportation modes including trains, ships, cars and private trains.

Note2: The contribution is computed as follows.

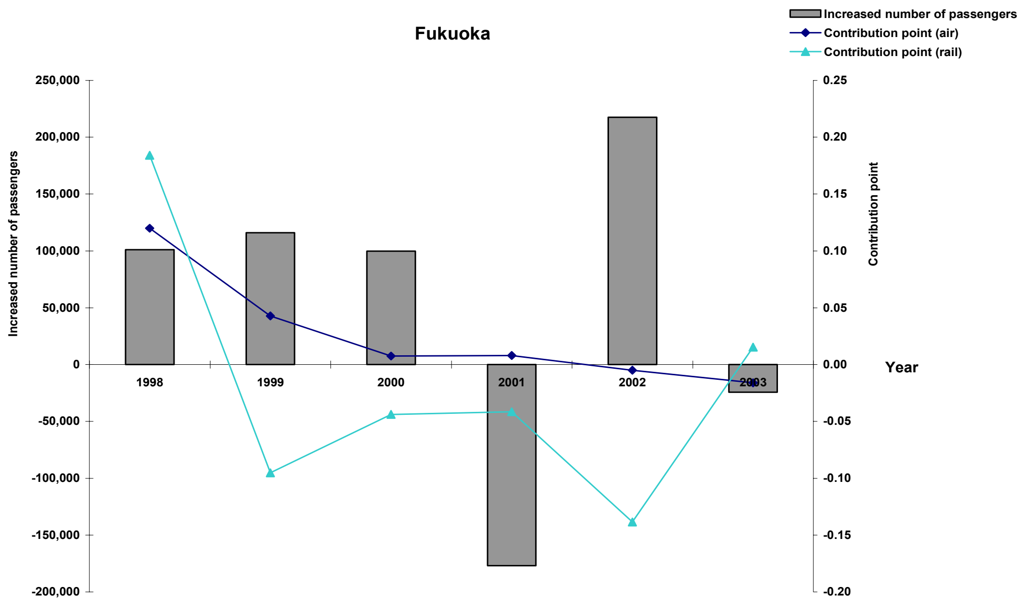
Contribution of transport mode i = $\Delta(y_2 - y_1)$ / the total number of passengers in year 1

= $\Delta(y_2 - y_1) / y_1 \times (y_1$ / the total number of passengers in year 1)

$\because y_1$ = the number of passengers in year and y_2 = the number of passengers in year 2

After 1999, the air transport contribution dropped except in the case of Okinawa. Hokkaido, where the air transport accounts for 97% of the movements, the rail contribution point has been increasing, particularly in 2002 as a result of the Tohoku Shinkansen (high speed rails) being connected to Hachinohe from Morioka.[20]

Figure 6.6: Air transport market growth contribution point to the total passenger growth in Fukuoka from 1998 to 2003



Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2003)

Notes: the total number of passengers means the total number of passengers who moved by all transportation modes including trains, ships, cars and private trains.

In Fukuoka, the air transport contribution was slightly higher than from the trains (see Figure 6.6), but has been decreasing. Moreover, the total number of passengers carried by air in the Fukuoka market did not grow significantly, even after the entry of Skymark in 1998. This is evidence of market saturation caused by the entry of a new entrant. Interestingly, the air transport market growth contribution in Osaka was lower compared with other areas. In addition, this was relatively stable even though demand for air transport on the Tokyo routes in this market was increasing (see Figure 6.7). It shows the Tokyo-Osaka market has a potential to develop more for both JR and air transport.

20 This extension enables connections from Tokyo to Aomori (the northeast prefecture in the Honshu main islands) by high speed rail (see Figure 4.1 in chapter 4).

This category 1 market (except in the case of Sapporo and Okinawa) has also had a strong competitor, high speed rail since the 1970s. The competition with high speed rail has affected the air transport market extensively. Further discussion and analyses were provided in chapter 4.

Figure 6.7: Air transport market growth contribution point to the total passenger growth in Osaka from 1998 to 2003

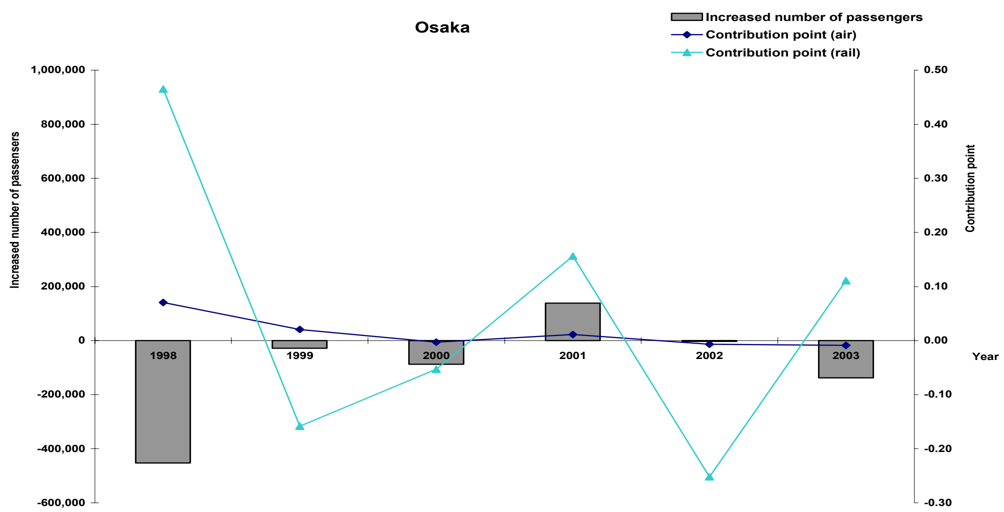
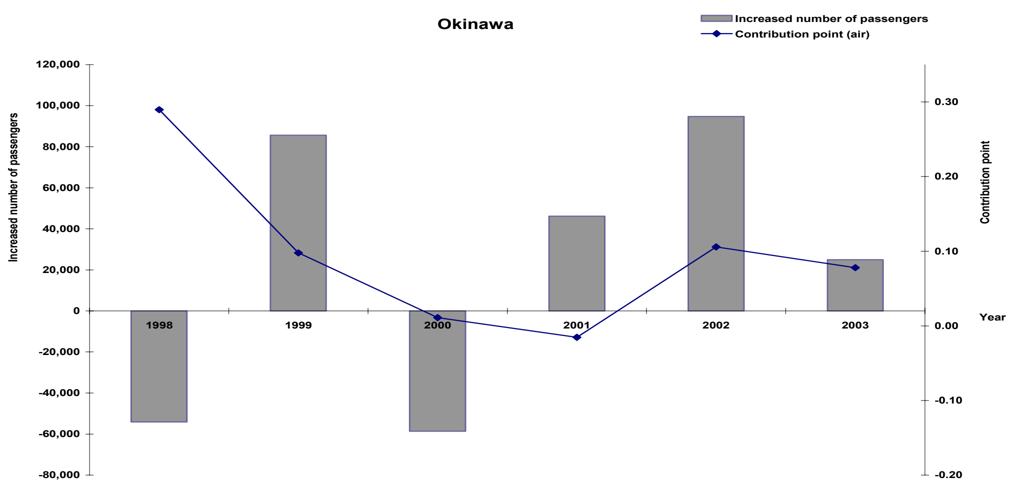


Figure 6.8: Air transport market growth contribution point to the total passenger growth in Okinawa from 1998 to 2003



Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2003)

Notes: the total number of passengers means the total number of passengers who moved by all transportation modes including trains, ships, cars and private trains. Okinawa does not have any surface transportation to other prefectures.

6.2 Category 2 routes

6.2.1 Characteristics: the Competitive routes

All of these destinations in this category are local political and economic centres.

Table 6.2 shows the characteristics of this category of routes.
Average frequency is 25 departures per day on relatively large scale aircraft carrying over two hundred passengers per flight.

Table 6.2: The characteristics of the routes in category 2 in 2000

Routes from Tokyo to	Stage Length (km)	Number of departures per year(day)	Number of passengers per year	Average number of passengers per flight	Average load factor
Kansai	687	10,552 (29)	2,325,985	220	64%
Hiroshima	790	9,916 (27)	2,231,196	225	65%
Komatsu	528	7,609 (21)	2,021,863	266	61%
Kagoshima	1,111	9,134 (26)	2,025,747	222	70%
Average	**804**	**9,295 (26)**	**2,151,198**	**231**	**65%**

Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Notes: the numbers are calculated using the statistics records of JCAB in 2000

The passenger demand in this market category has been influenced not only by the demography of the airport location city, but also by the populations of the surrounding areas and the relatively strong economic activities at each airport periphery area like Hiroshima and Komatsu (see Table 6.3). Therefore, these routes have been considered as semi-trunk routes in the domestic market in Japan.

The Hiroshima and Komatsu routes have been two of the most valuable business routes in the local domestic market because of their strong economic background (GDP per capita: Hiroshima, USD 24,083 and Komatsu, USD 24,117). Both air routes offer fast travel times for business travellers compared with surface transportation.

Table 6.3: The demographic and economic background of category 2 routes

Airport	Background area (Prefecture)	Population (millions)	GDP growth ratio in 2001	Income per capita JYE(000) in 2001	CPI growth rate in 2003	Budget index in 2002
Kansai	Osaka	8.82	-2.3	3,096	-0.3	0.7111
	Nara	1.44	-1.8	2,703	-0.8	0.333
	Wakayama	1.06	-1.6	2,396	-0.6	0.245
	Mie	1.86	-3.4	2,853	-0.1	0.454
	Hyogo	5.59	-5.2	2,657	-0.4	0.489
	Kyoto	2.64	-5.6	2,768	-0.4	0.499
Hiroshima	Hiroshima	2.88	-2.2	2,904	-0.4	0.454
	Okayama	1.95	1.0	2,791	-0.1	0.392
Komatsu	Ishikawa	1.18	-2.2	2,950	-0.4	0.377
	Fukui	0.83	-1.1	2,903	-0.6	0.335
	Toyama	1.12	-3.7	2,916	-0.4	0.341
Kagoshima	Kagoshima	1.77	-1.5	2,285	0.0	0.266
	Miyazaki	1.16	-3.9	2,440	-0.1	0.249
	Kumamoto	1.85	-2.2	2,522	-0.6	0.308

Source: Author based on data from Ministry of Internal Affairs and Communications in Japan, Statistics Bureau (2005)

Note: Budget index is computed by deviding the budget revenue of the local government by their expected expenditures. It shows the strength of the financial standings of the local governments.

However, Figure 4.4 in chapter 4 shows that there is a discrepancy between demand and supply, with airlines having aggressively introduced large-scale aircraft as these routes are considered semi-trunk routes after the relaxation of the double and triple designation rules.

In 1995, load factor plummeted and the oversupply situation has become remarkable on these routes following deregulation in 2000. In the next section, Hiroshima routes will be examined in detail as an example of this case in order to investigate the reasons for this situation and the key factors contributing to market growth.

6.2.2 The Hiroshima routes market

Former Hiroshima airport (now called Hiroshima-nishi airport) was opened in 1961 with its 1,200 m runway being extended to 1,800 m in 1972. The new Hiroshima airport was constructed in another location in the mountains, about 50 km east from the centre of the city of Hiroshima, and opened in 1993 with a 2,500 m runway to accommodate large jet aircraft operations. The runway was extended to 3000 m in 2001 in order to accept international flights (see Table 6.4).

Table 6.4: Number of carriers and type of aircraft at Hiroshima airport

Year	Runway length (m)	Carriers	Average carried passengers per flight	Average seats per flight	Type of aircraft
1980	1,200	NH	87	94	YS11
1985	1,800	NH	167	234	B737
1990	1,800	NH/JL/JS	221	281	B767
1995	2,500	NH/JL/JS	233	338	B747
1999	2,500	NH/JL/JS	256	369	B747/B777
2000	2,500	NH/JL/JS	225	345	B747/B777
2001	3,000	NH/JS	194	345	B747/B777

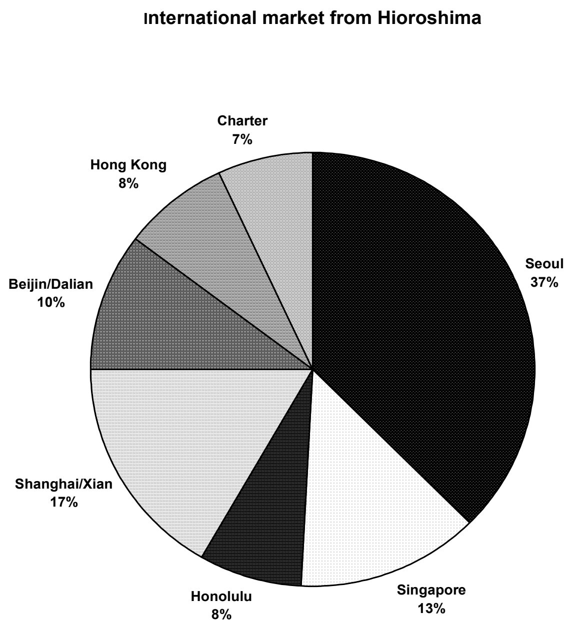
Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (From 1980 to 2003)

Note: Two letter codes refer to the name of the airline, NH (All Nippon Airways), JL (Japan Airlines) and JS (Japan Air System).

In spite of oversupply, this Hiroshima market is slowly but steadily increasing among category 1 and category 2 markets (see Figures 6.3 and 6.4).

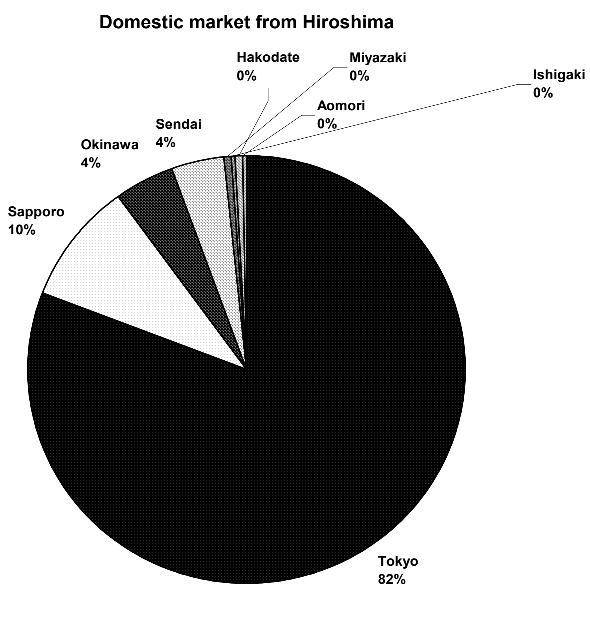
Air transport on Tokyo-Hiroshima has seen strong growth compared with other modes of transportation. The Tokyo-Hiroshima routes accounted for 82% of the domestic air transport market from Hiroshima in 2003 (see Figure 6.10). In response to the runway extension at Hiroshima airport in 1995 so B747 and more international flights could be accepted (see Table 6.4, Figures 6.9 and 6.10), airlines introduced large-scale aircraft on all flights. By doing so, they fulfilled the specific demands of business travellers during periods of high demand. This resulted in the relatively low load factors in these route categories.

Figure 6.9: Destinations served from Hiroshima Airport (International flights) in 2003



Source: Ministry of Land, Infrastructure and Transport, Aviation statistics (2003)

Figure 6.10: Destinations served from Hiroshima Airport (Domestic flights) in 2003



Source: Ministry of Land, Infrastructure and Transport, Aviation statistics (2003)

Although in the category 1 and category 2 markets, which cover the large domestic market in Japan and in which new entrants have featured, the growth rate of demand has been insignificant. In fact, on the Sapporo and Fukuoka routes from Tokyo, which have seen more new entrants, traffic in 2003 dropped. On other routes like to Kansai, demand has steeply declined at 18.5% over the previous year, with the growth rate since 1997 at only 5% (see Figures 6.3 and 6.4). The market growth on the Tokyo–Hiroshima routes has been delivered by competition between air transport and high speed railways rather than by new airline entrants as discussed in chapter 4. The findings in chapter 4 are hereby confirmed for route categories 1 and 2.

6.3 Category 3 routes

6.3.1 Characteristics: Local centres and VFR traffic

All of the routes in the category 3 markets are located in other large islands (Kyushu and Shikoku) from Honshu (Main Island, where Tokyo is situated) and the average distance from Tokyo is about 900km. These destinations are not only the locations of the prefecture government but they are also big VFR markets in Japan. Therefore this market is characterised by seasonal demand and it results in relatively low load factors (see Table 6.5).

Table 6.5: The characteristics of the routes in category 3 in 2000

Routes from Tokyo to	Stage Length (km)	Number of departure per year(day)	Number of passengers per year	Average Number of passengers per flight	Average load factor
Kumamoto	1056	6,494(18)	1,460,076	225	66%
Hakodate	786	5,547(15)	1,146,330	207	63%
Miyazaki	1023	7,021(19)	1,248,306	178	60%
Nagasaki	1143	6,505 (18)	1,542,253	237	63%
Okayama	685	2,889 (8)	359,017	124	58%
Takamatsu	711	5,398 (15)	1,094,735	203	67%
Matsuyama	859	5,787 (16)	1,228,202	212	72%
Oita	928	6,554 (18)	1,197,224	183	60%
Average	**899**	**5,774 (16)**	**1,159,518**	**196**	**63%**

Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Table 6.6: The demographic and economic background of category 3 routes

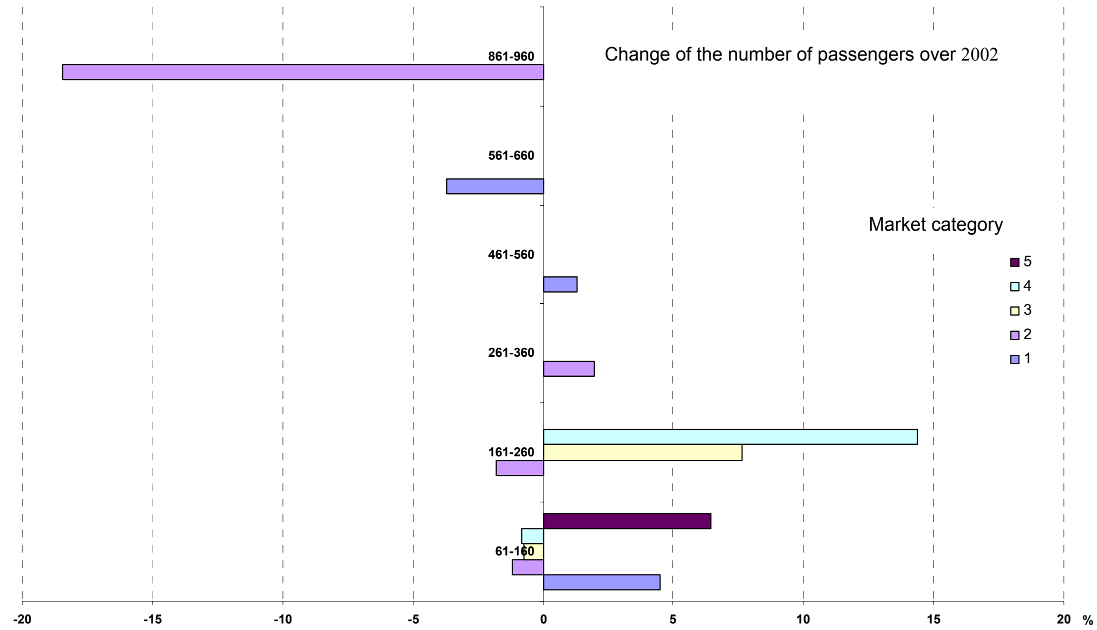
Airport & Prefecture	Population (million)	GDP growth in 2001	Income per capita JYE (000) in 2001	CPI growth in 2003	Budget index in 2002
Kumamoto	1.02	-2.2	2,522	-2.6	0.308
Miyazaki	1.16	-3.9	2,440	-0.9	0.249
Nagasaki	1.5	-1.4	2,336	-3.3	0.232
Okayama	1.95	1	2,791	-5.1	0.392
Takamatsu	1.02	0	2,746	-4.3	0.356
Matsuyama	1.48	-1.2	2,466	-3.3	0.316
Oita	1.22	-5.2	2,632	-1.3	0.271
Average	**1.34**	**-1.8**	**2,562**	**-3.5**	**0.354**

Source: Author based on the data from Ministry of Internal Affairs and Communications in Japan, Statistics Bureau (2005)

Socio and economic indices used in this analysis are listed in Appendix N: List of socio-economic indices by prefecture.

Figure 6.11 compares average percentage change in the number of passengers in 2002 by category with 2003 according to the population size. Overall, category 3 market routes had similar population backgrounds and traffic volumes increased compared with other markets. However, traffic volumes dropped on the routes where the population range was from 0.61 to 1.6 millions. These routes include the Tokyo-Miyazaki route, where a new entrant (Skynetasia airlines) entered in 2003. On the other hand, in the Tokyo- Okayama route market, where the population was about 2 million and income per capita was JYE 2,791, the traffic increased by competition with HSR.

Figure 6.11: Average percentage change of the number of passengers over the previous year by category in 2003



Source: Author based on data from Ministry of Internal Affairs and Communications in Japan, Statistics Bureau (2005) and Ministry of Land, Infrastructure and Transport, Aviation statistics (2003)

Note 1: The numbers (in thousands) refer to the population range of the market based on the Population data in 2003.

Note 2: The large increase in category 4 markets was caused by restarted services on the Tokyo-Yamagata city-pair.

The category 3 market is a large tourism market for air transport as well. Table 6.7 shows the proportion of leisure travel by each mode of transportation by region for the year 2002. Air transport accounted for 16% in the Shikoku area and 21 % in the Kyushu area (both of which are category 3 routes) compared with the average of 8.7%. In addition, the ratio of tertiary industry in the category 3 market is high (83%) compared with other market categories (average: 79%).

Appendix O: The proportion of the labour forced engaged in tertiary industry in each prefecture by market category

Table 6.7: Transportation mode used for leisure travel in Japan (2000)

	Rail (%)	Automobile (%)	Ship (%)	Air (%)	Others (%)	Unknown (%)
Hokkaido	8.2	93.8	0.3	12	0.7	1
Tohoku	14.8	88.9	0.3	8.2	1.8	-
Kantou	22.3	82.7	1.4	7.2	1.1	2.3
(Tokyo)	28.1	79.2	1.9	6.7	0.5	3.5
Hokuriku-koushinetsu	20.8	88.9	2.7	5.5	0.8	1
Tokai	19.0	86.4	2	8.4	0.6	1.5
Kinki	24.1	80	1.5	8.5	0.8	0.4
Chugoku	30.0	84.3	4.1	5.9	0.4	0.4
Shikoku	8.7	86.5	1.6	20.6	1.6	-
Kyushu	10.2	83.3	8.2	16.0	1.9	0.5
Average	**19.7**	**84.8**	**2.2**	**8.7**	**1**	**1.2**

Source: Author based on data from the 9th Nation wide Travel Movement Survey Report (Statistics Bureau in Japan, 2002)

Notes: This survey is carried out every five years. All travels are excluding one-day return trips.

6.4 Category 4 and 5 routes

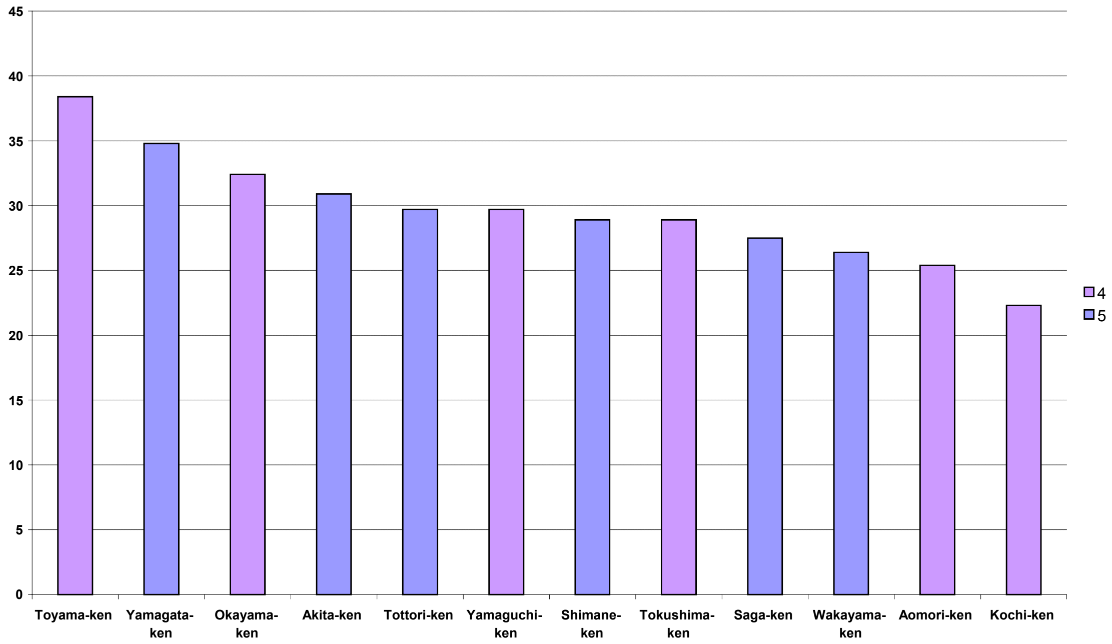
6.4.1 Characteristics: the Local city, secondary and newly opened airports routes

Airports in market categories 4 and 5 are situated in the same locations of local prefectures' government offices as the category 3 market. However, all of the demographic and economic backgrounds in these areas are not as large as in category 3. The population range in categories 4 and 5 is from 0.8 to 1.2 million per prefecture. Average income per capita is around USD 19,000-23,000 (1USD = JYE126, April 2001). This is relatively high because some regions have strong local based secondary industries, like Toyama. The labour force index of secondary industry [21] in these prefectures is 38.4 in Toyama and 32.4 in Okayama (see Figure 6.12, average 29.5 in Japan). Moreover, the proportions of primary industries in route categories 4 and 5 are

[21] This index is computed by the proportion of the number of employees in secondary industry over the total number of employees of all industries in each prefecture.

slightly higher compared to other route categories. The average labour force index of primary industry in category 5 is 11.0 and 9.2 in category 4 compared with 5% on average in Japan.

Figure 6.12: Proportion of the labour force (the labour force index) in secondary industries by prefecture in categories 4 and 5 in 2005



Source: Author based on data from Ministry of Internal Affairs and Communications in Japan (2005)

Appendix P: The primary industry labour force proportion by prefecture
Appendix Q: The secondary industry labour force proportion by prefecture

It is crucial to have stable and convenient transportation access to Tokyo for these local cities as all the economic and political activities are concentrated in the Japanese capital. Several secondary airports such as Iwami (opened in 1993), Odatenoshiro (in 1998), Saga (in 1998) and Noto (in 2003), were opened in these route categories in order to promote their economy and provide greater access to major cities. In addition, air transport in route categories 4 and 5 has obtained an advantage compared to other modes of transport because these routes have long surface journey times reflected in the strong time indices from 0.74 to 0.84 (c.f. supra, chapter 4).

Table 6.8: The characteristics of the routes in category 4 in 2000

Airport	Stage Length (km)	Number of departures per year(day)	Number of passengers per year	Passengers per flight	A207verage load factor
Akita	555	4,727(13)	882,392	187	61%
Toyama	570	4,205(12)	872,164	207	70%
Yamaguchi	935	3,637(10)	670,223	184	67%
Tokushima	703	5,063(14)	807,927	160	61%
Kochi	824	5,637(15)	861,112	153	62%
Asahikawa	1,052	4,783(13)	735,004	154	57%
Aomori	690	5,783(16)	978,419	169	65%
Kushiro	1,032	3,758(10)	530,830	141	58%
Average	**795**	**4,703(13)**	**792,259**	**168**	**62%**

Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Table 6.9: The characteristics of the routes in category 5 in 2000

Airport	Landing charge Reduction*	Stage Length (km)	Number of departures per year(day)	Number of passengers per year	Average number of passengers per flight	Average load factor
Yonago		776	2,867(8)	369,201	129	59%
Izumo		801	3,078(8)	517,710	168	57%
Memanbetsu		1,156	3,078(8)	503,609	164	59%
Obihiro		999	2.895(8)	517,457	179	61%
Tottori		667	2,188(6)	310,650	142	64%
Kitakyushu		958	1,946(5)	259,662	84	71%
Misawa		685	2,836(6)	239,355	84	60%
Nankishirahama	X	634	1,856(5)	135,134	73	51%
Odatenoshiro	X	628	1,208(3)	116,521	96	64%
Saga	X	1,130	1,458(4)	162,605	112	66%
Wakkanai	X	1,195	1,014(3)	146,637	145	66%
Nakashibetsu	X	1,118	1,437(4)	90,681	63	63%
Yamagata	X	441	728(2)	59,633	82	58%
Iwami	X	907	1,447(4)	59,986	41	64%
Average		**889**	**2,016(6)**	**235,892**	**130**	**61%**

Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2000).

Note: landing charge reduction * refers landing charge at Haneda airport is reduced by 50%.

In order to protect the routes and promote demand, three PSO policies were provided to the routes in categories 4 and 5: (1) 20 PSO slots allocation in 1997 to five routes from Tokyo like Iwami, Nakashibetsu, Wakkanai, Saga and Odatenoshiro, (2) 4 PSO slots were allocated in 2000 to two newly opened airports routes from Tokyo like Noto and Shin-monbetsu, (3) two flights on the route rule: slots are pooled by government in case the number of flights becomes less than two flights per day on the route from Tokyo by airlines as a result of slot allocation at Haneda airports. Moreover, landing charges on ten routes like Wakkanai, Yamagata, Monbetsu, Nakashibetsu, Odatenoshiro, Noto, Nankishirahama, Iwami and Saga from Tokyo are reduced to 50% (see Table 6.9).

Table 6.10: The demographic and economic background of category 4 routes

Airport	Population (million)	GDP (at current price) USD million in 2000	GDP growth ratio in 2001	Income per capita JYE(000) in 2001	CPI growth ratio in 2003	Budget index in 2002
Akita	1.17	36,779	-1.5	2,402	-2.5	0.232
Toyama	1.12	43,150	-3.7	2,916	-7	0.341
Yamaguchi	1.51	54,654	-1.5	2,801	-4	0.351
Tokushima	0.82	25,051	-2.2	2,659	-4.4	0.265
Kochi	0.81	24,303	-2.6	2,318	-1.5	0.199
Aomori	1.46	44,872	-2.6	2,359	-1.4	0.257
Average	**1.15**	**38,135**	**-2.4**	**2,576**	**-3.7**	**0.274**

Source: Author based on data from Ministry of Internal Affairs and Communications in Japan (2006)

The categories 4 and 5 markets are characterised by secondary and newly opened airports. Most airports are owned and managed by local governments (c.f. infra, chapter 9). Odatenoshiro airport opened in 1998 in Akita prefecture, about 600 km north from Tokyo and Akita airport established in 1982. Aomori prefecture has Aomori and Misawa airport. Both of these routes from Tokyo have competition with high speed rail since the Akita and Tokoku high speed rail services opened in 2002 (c.f. supra, chapter 4). Noto airport opened in 2003 in the Hokuriku area, includes Toyama, Ishikawa and

Kanagawa prefectures, which already had two airports. Besides, other prefectures like Shimane and Tottori prefecture have four airports, Yonago, Tottori, Izumo and Iwami airport in the same economic region, about 900 km west from Tokyo. However, the economic activity scale in this area is not large enough to have four airports, as the total number of population in this area was less than 1.4 million, the total amount of GDP was USD 45,453 million in 2002, income per capita was around USD 23,800 in 2001 and GDP growth ratio varied from -0.6 to -0.7 % in 2003. Especially demand on the Tokyo-Iwami route dropped due to reduced frequencies after the Phase II Slot Allocation in 2002. These airports are owned and managed by local governments. Its burden reflects the budgets indices of these prefectures, which were very low around 0.22 compared with the nation average 0.4[22] (see Table 6.11).

Table 6.11: The demographic and economic background of category 5 routes

Airport	Prefecture	Population (million)	GDP at current price(USD million) in 2000	GDP growth ratio in 2001	Income per capita JYE(000) in 2001	CPI growth ratio in 2003	Budget index in 2002
Yonago **Tottori**	**Tottori** **Tottori**	0.61	21,555	-0.7	2,524	-3.3	0.220
Nankishirahama	**Wakayama**	1.06	31,513	-0.7	2,396	-4.4	0.245
Odatenoshiro	**Akita**	1.17	36,779	-1.5	2,402	-2.5	0.232
Saga	**Saga**	0.87	27,714	-3.6	2,453	-1.3	0.272
Yamagata	**Yamagata**	1.23	40,897	-5.9	2,446	-2.6	0.275
Izumo **Iwami**	**Shimane** **Shimane**	0.75	24,303	-0.6	2,478	-0.4	0.201
Average		**0.94**	**30,460**	**-2.2**	**2,452**	**-2.4**	**0.241**

Source: Author based on data from Ministry of Internal Affairs and Communications in Japan (2006)

22 Budget index of Shimane prefecture was 0.2 and that of Tottori was 0.22 in 2002. They were ranked the worst and second worst in Japan.

Thus, many of airports were opened in categories 4 and 5 in order to improve the economic activities by developing air transport industry including airport construction business. Several slots were provided on the routes of these categories as Public Obligation Slots and other incentives like landing charge reductions were granted for nine routes on these route categories. However, during the process of the slots allocation system, airlines reduced frequencies and raised fares on these routes and as a result of liberalisation, demand and frequency dropped. As a consequence, the debt to construct and maintain airports become a burden for local government finance and hence, to tax payers in these regions.

Table 6.12: Summary of economic and demographic background on routes from newly opened airports to Tokyo

Airport	**Category**	**Prefecture**	**Population (millions)**	**GDP at current price (USD millions) 2000**	**Income per capita JYE(000) 2001**	**Budget index 2002**	**HSR competition**
Yonago	5	Tottori	0.61	21,355	2,524	0.220	N
Tottori	5	Tottori					N
Izumo	5	Shimane	0.75	24,098	2,478	0.201	N
Iwami	5	Shimane					N
Total number of population and GDP in the region			**1.36**	**45,453**			
Akita	4	Akita	1.17	36,779	2,402	0.232	Y
Odatenoshiro	5	Akita					Y
Total number of population and GDP in the region			**1.17**	**36,779**			
Aomori	4	Aomori	1.46	44,872	2359	0.257	Y
Misawa	5	Aomori					Y
Total number of population and GDP in the region			**1.46**	**44,872**			
Saga	5	Saga	0.87	27,714	2,453	0.272	Y
Fukuoka	1	Fukuoka	5.05	166,298	2,529	0.513	Y
Kitakyushu	5	Fukuoka					Y
Yamaguchiube	4	Yamaguchi	1.51	54,654	2,801	0.351	Y
Total number of population and GDP in the region			**7.43**	**248,666**			
Toyama	4	Toyama	1.12	43,150	2,916	0.341	N
Komatsu	2	Ishikawa	1.18	43,137	2,950	0.377	N
Noto	5	Ishikawa					N
Total number of population and GDP in the region			**2.3**	**86,287**			

Source: Authour based on data from Ministry of Internal Affairs and Communications in Japan (2006)

6.5 Category 6 Routes

6.5.1 Characteristics: the remote island routes

This category market is composed of routes to remote islands in Japan. Hachijyojima, Oshima and Miyakejima belong to the Tokyo metropolitan administration, while Amamioshima is in the Kagoshima prefecture and Ishigaki, Amamioshima, Miyakojima and Kumejima are the Okinawa prefecture. Air transportation is not only an important lifeline for local people but is also crucial for promoting tourism to these islands, which are located in a tropical climate. Most of the routes like those to Amamioshima, Ishigaki and Kumejima are very attractive sun tourism destinations with limited capacity by airlines. For example, the Tokyo-Kumejima routes are operated only several months of the year in the summer from Tokyo using B-737. Average *annual* load factor on the Tokyo-Kumejima route is very high, because this route operates only *several* months during the summer. Most of these flights are fully booked in spite of the very high fares (see Tables 6.13 and 6.14).

Table 6.13: The characteristics of the routes in category 6 in 2000

Airport	Stage Length (km)	Number of departures per year(day)	Number of passengers per year	Average passengers per flight	Average load factor
Hachijyojima	353	2,859(8)	236,040	83	54%
Oshima	162	2,030(6)	90,275	44	70%
Ishigakii	2,171	954(3)	116,232	122	72%
Amamioshimai	1,436	718(2)	72,840	101	62%
Miyakojima	2,020	724(2)	84,004	116	70%
Kumejima	1,888	237(1)	25,402	107	72%
Average	**1,333**	**1,254(3)**	**104,132**	**83**	**67%**

Source: Author based on data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

The Hachijyojima, Oshima and Miyakejima routes from Tokyo are more commuter routes rather than the sunshine tourism destinations. Landing charges on all of these category 6 routes are reduced to 1/6 as important PSO routes for remote island areas in

Japan to promote air transport and protect the local citizens' convenience. However, demand, supply and frequency went down while fares increased after liberalisation.

Table 6.14: Fares and Time index the in category 6 market

Airport	Total time(flight + access &egress)	Normal fare (JYE)	Peak fare (JYE)	Discount fare (highest) (JYE)	Discount fare (lowest) (JYE)	Time index
Hachijyo	50	17,100	16,700	16,700	16,700	0.03
Oshima	55	11,000	10,700	7,700	7,700	0.17
Miyakejima	70	13,000	14,000	13,200	13,200	0.07
Amamioshima	185	36,500	41,500	36,500	36,500	0.09
Kumejima	190	44,900	44,900	27,500	27,500	0.08
Miyako	195	48,700	48,800	38,000	28,000	0.09
Ishigaki	195	50,200	52,200	38,000	33,800	0.09

Sources: Author based on data from Japanese airlines' timetables (JAL and ANA) in June 2005 and Ministry of Land, Infrastructure and Transport, Aviation statistics (2005).

Notes: Fares are including security and fuel surcharge JYE600.

6.6 The effects of the slot allocation system on the market

Airlines have been operating large capacity aircraft with low load factors in order to satisfy the specific demands during the peak season and periods of the day on the Tokyo routes. After deregulation and the changes to the slot allocation policy, competition should have resulted in increased demand. Shortly after deregulation, competition seemed to have indeed been experienced in the market, but this trend did not last very long. In this section, the results and effects of the slot allocation system are analysed with respect to each category market, along with the process of each allocation: Phases I (from 1997 to 1999), II (from 2000 to 2004) and III (from 2005 to 2009). Due to data limitations, the effects are only analysed up to Phase II (until 2004).

In 2001, following liberalisation and the first impact of the Phase II Slot Allocation in 2000, the overall market grew. Table 6.15 shows market size and average demand and supply changes over the previous year by category in 2001, 2003 and 2004. Even though market supply in route categories 3, 4 and 5 decreased, demand increased over the previous year. Both supply and demand grew in market categories 1 and 2, but after three years the situation turned out differently, despite additional slots becoming available under the Competition promotion slots 2002 policy. Comparing 2003 and 2002, demand in category 1 routes increased only 2.94% over the previous year, against an increased seat supply of 7.96%. In other markets the traffic volumes and flight frequencies decreased. Just before the Phase III Slot Allocation in 2005, all of the indices in Table 6.15 demonstrate a decrease in all route categories. In addition, HHI indices show low competitive intensity in the markets during the process of the slot allocation system. In spite of the aims to promote competition and increase demand by slot allocation at Haneda airport, it is apparent that competition has diminished between airlines.

Table 6.15: Average demand and supply change (%) over the previous year by market category in 2001, 2003 and 2004

Year	Category	Number of departures	Number of passengers	Number of seats supplied	Load factor(%)	HHI	% increase over the previous year			
							Frequency	Demand	Supply	Load factor (%)
2001	1	23,089	6,630,066	9,852,31	68.1	0.33	7.96	6.56	6.42	0.21
	2	9,939	2,213,753	3,324,106	66.7	0.40	6.76	2.90	0.58	2.47
	3	6,505	1,290,556	2,081,797	62.9	0.51	3.54	3.82	4.73	-0.82
	4	4,784	811,642	1,264,951	64.2	0.64	1.69	2.67	-0.37	3.09
	5	1,945	260,509	408,640	61.5	0.96	3.14	4.50	-0.87	5.58
	6	1,236	109,416	165,894	68.7	1.00	-0.36	3.53	0.32	3.66
2003	1	24,955	7,030,702	10,938,476	65.5	0.45	6.85	2.96	7.96	-4.42
	2	10,884	2,148,862	3,543,872	61.5	0.48	-0.59	-4.86	-0.39	-3.94
	3	8,218	1,400,466	2,326,290	60.6	0.50	10.33	1.49	3.12	-1.25
	4	5,300	856,675	1,432,797	60.0	0.57	4.74	-0.92	6.08	-6.26
	5	1,943	235,892	389,232	61.0	0.97	1.59	-1.55	-0.92	-1.38
	6	1,250	108,969	179,458	62.1	0.87	3.86	4.45	7.80	-5.86
2004	1	25,271	7,051,704	10,910,322	65.2	0.45	1.20	0.74	1.20	-0.35
	2	10,675	2078,872	3,262,843	64.9	0.47	-1.27	-3.17	-7.74	5.58
	3	8,051	1,358,999	2,158,973	63.5	0.49	-3.00	-3.07	-7.49	5.13
	4	5,100	843,144	1,315,983	63.9	0.61	-3.61	-1.50	-6.96	6.81
	5	2,023	245,702	384,398	63.6	1.00	1.06	1.24	-1.74	3.19
	6	1,185	104,559	172,828	63.3	0.94	-5.90	-4.98	-3.99	1.97

6.6.1 Fares

In the process of deregulation, the number of fare types increased from 4 in 1985 to 8 in 2000 and over 19 in 2005. Appendix R shows examples of the types of fares in the domestic market in Japan. Even after deregulation, airlines have been reporting to Government the types and levels of fares two months before departure, which are then published in airline timetables. Although two months notice for fare setting is not regulated in the air law, which only mentions “advanced notice”, this notice period became a kind of traditional custom in Japanese airlines. It is because of the so-called “meeting for schedule arrangement”, under which airlines discuss their schedule arrangements every two months. The fare setting policy according to distance has not been changed even after deregulation.

Appendix R: Types of fares and prices on selected Tokyo routes in June 2005

This situation is also evidenced from the data of Table 6.16, which shows average fares and the annual price increases (%) over the previous year by market category in 2001, 2003 and 2004. The highest fares were not increased at all compared with 2000 in all route categories, while the lowest fares went down except for categories 3 and 4 in 2001. The discount rate of the lowest fares was between 44% and 55 % of the highest fare in the overall market. In the category 3 market, which is the main VFR market of the Tokyo routes, the discount fares were raised by around JYE5,000 (USD39.6) [23]on each route in 2001. This was especially evident on the Tokyo-Oita and Tokyo-Nagasaki routes, where passenger demand decreased. Overall, the discount rates of these fares were raised in 2000. In 2003, the highest fares were decreased by about 9.9% in route categories 1 and 2, which have competition from both new entrants and high speed railway services. The difference between the highest and lowest fare was down to 53% from 55% in route category 1 as a result of the discount fares being increased. On category 3 routes, the highest fares were down by about 9% and the highest discount fares were 6.6% lower because of new entry. In other route categories, especially relatively low demand markets like categories 4 and 5, the difference between the

[23] The exchange rate adopted here is the Representative Rates for Selected Currencies, which was reported in the exchange rate archives by month of the International Monetary Fund in April 2001; USD 1 = JYE126.3.

highest and lowest fares had decreased by about 20%. As a result, fares were raised in 2003 in all route categories despite liberalisation and the Haneda airport slot allocation (Phase II). The differences between the highest and cheapest fares were reduced more and more, especially in low demand markets.

The decreasing spread in highest and lowest fares accelerated in 2004 and 2005. Table 6.16 shows the ratio of discount fares over fully flexible fares in June 2005 for each route category. The discount levels of the most expensive discount fares were less than 30% and those of the cheapest discount fares varied between 24% and 52 %. The average difference between the highest and lowest discount fare was only 16% over all the Tokyo routes. Some of the routes operated by new entrants had discounts of more than 70%. However these cheapest discount fares are very limited. Besides, on the routes operated by Air Do, such as Tokyo–Sapporo and Tokyo-Asahikawa, the difference between discount fares was around 20% to 29 %, which is almost the same as in other duopoly markets operated by JAL and ANA. This is due to the management cooperation between ANA and Air Do, since Air Do had been under the Civil Rehabilitation Reorganisation Act since 2002.[24]

In 2005, the competitive situation seems to have faded away between airlines even including the new entrants. JAL and ANA have been setting exactly the same fares on almost every route, even though another new entrant (Skynetasia) provided simple and very low discount fares (less than 70% of the normal fare). On other routes, operated by Skymark and Air Do, fares showed 10%-20% rates of discount.

Despite liberalisation, all fares and schedules are fixed and published in the airlines timetables two months before departure. The discounted fares are refundable even though some charges are made. Moreover, the differences in discount fares are not so prominent. For example, the maximum discount rate of the 21 days advanced booking fares was 57% and that of the 7 days advanced booking discount fares was 58% on the Tokyo-Sapporo route in June 2005. However, some one day advanced booking discount

[24] This law was established in 2000 in order to revitalise a company, which was bankrupt, but still has a possibility to recover. The airline has fallen under the court for revitalisation.

fares were more than 61 % of the fully flexible fares. On the Tokyo-Fukuoka route, the difference between the fully flexible fares and the discount fares was only JYE 1,500 (USD13.84).[25] In addition, some of the 7 days advanced booking fares were cheaper than the 21 days advanced booking fares and one day before departure booking fares vary from 25 % to 60% discount on the fully flexible fares in the Tokyo routes market. Passengers can not obtain much discount on price even though they booked and paid in advance. In other words, they possess opportunities to book and purchase discount fares at better prices, even only one day before departure. This fare setting policy of the airlines, which has been showing this tendency since 1997, did not change even after liberalisation.

[25] The exchange rate adopted is the Representative Rates for Selected Currencies, which was reported in the exchange rate archives by month of the International Monetary Fund in June 2005; USD 1 = JYE108.35.

Table 6.16: Average fares and annual price changes (%) over the previous year by route category in 2001, 2003 and 2004

Year	Category	Number of airlines	Average number of new entrants	Highest fare (JYE)	Highest discount fare (JYE)	Lowest discount fare (JYE)	% fare increase over the previous year			
							Highest fare	Highest discount fare	Lowest discount fare	Lowest fare
2001	**1**	3.8	0.5	28,000	21,750	12,475	0.00	4.17	-2.95	0.55
	2	3.0	0.0	24,000	16,375	13,375	0.00	6.62	-6.18	0.44
	3	2.4	0.0	28,625	21,563	17,538	0.00	14.12	22.81	0.39
	4	1.9	0.0	26,500	20,563	14,163	0.00	0.99	13.70	0.45
	5	1.1	0.0	28,188	21,672	16,000	0.00	5.03	-3.70	0.42
	6	1.0	0.0	35,500	19,500	14,958	0.00	-5.68	-5.38	0.50
2003	**1**	2.8	0.5	25,225	21,500	11,700	-9.90	3.10	2.53	0.53
	2	2.5	0.3	21,625	15,625	11,075	-9.86	-4.00	3.65	0.46
	3	2.4	0.4	26,113	20,813	15,438	-8.70	-6.58	-2.27	0.40
	4	1.1	0.0	24,613	20,188	13,200	-6.21	-3.08	2.45	0.46
	5	1.0	0.0	26,953	22,700	19,400	-6.61	2.63	35.40	0.29
	6	1.4	0.0	33,550	26,125	19,383	-3.83	44.02	41.32	0.34
2004	**1**	2.5	1	27,875	23,675	11,838	10.23	9.85	2.55	0.57
	2	2.25	0.25	24,000	17,875	10,500	10.94	12.62	-3.90	0.55
	3	2	0.25	28,625	22,288	15,250	9.66	7.35	0.71	0.46
	4	2.25	0.29	26,438	21,400	14,625	6.89	5.19	12.56	0.45
	5	1	0.0	28,813	24,084	20,969	9.49	8.66	16.29	0.26
	6	1.17	0.0	35,333	26,900	21,050	4.34	3.43	7.20	0.33

Sources: Author based on data from Japanese Airlines' timetables (JAL, JAS, ANA, SKY, ADO, SNET) in April 2000-2004 and Ministry of Land, Infrastructure and Transport, Aviation statistics (2000 -2004)

Table 6.17: Fares and levels of discount fares versus fully flexible fares on Tokyo routes by category in June 2005

Category	Fully flexible fare (USD)	Discount fare (highest) (USD)	Discount fare (lowest) (USD)	Ratio of discounted (highest)	Ratio of discounted (lowest)
1	279.8	217.0	131.7	0.78	0.47
2	227.5	172.2	103.5	0.76	0.48
3	279.5	228.1	158.9	0.82	0.57
4	250.3	197.1	159.8	0.78	0.64
5	256	215.4	195.9	0.84	0.76
6	301.3	215.5	189.8	0.77	0.71
Total	**265.0**	**210.9**	**169.1**	**0.81**	**0.65**

Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics in 2005

Notes: All fares are excluding special fuel charge (JYE300), special security charge (JYE300) and Haneda airport charge (JYE100)

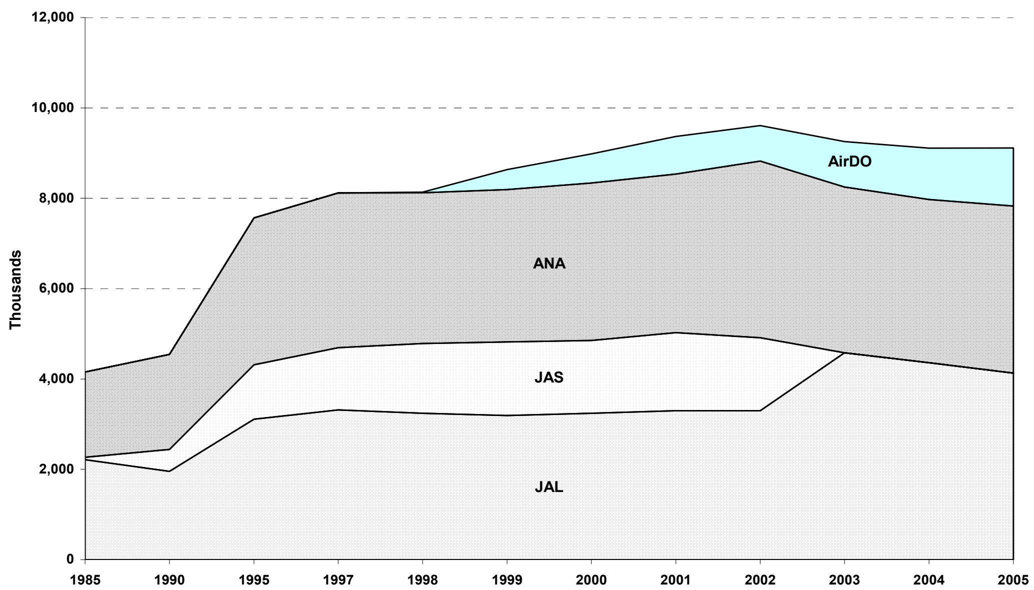
Appendix S: Fares and percentage changes of discount fares versus normal fares on Tokyo routes by category in June 2005

6.6.2 New entrant routes

Skymark entered the Tokyo-Fukuoka route in September 1998, while Air Do started operating the Tokyo-Sapporo route in December 1998. Traffic volumes on these routes (Category 1) are very high and accounted for more than 30% of all domestic Tokyo routes in 2001, with more than 85 departures provided daily on each route. Figure 6.13 shows the annual number of passengers carried on the Tokyo-Sapporo route from 1985 to 2005. Passenger demand increased extensively from 1985 to 1996 because of the effects of deregulation which was started in 1985 and the increased slots availabilities as a result of the sea-side extensions at Haneda airport (c.f. infra, chapter 9). However, the effects of a new entrant, Air Do on the market were not so prominent. Air Do had been suffering financial problems since 1998 and was under the Industrial Revitalisation

Cooperation Act (IRCA)[26] with management support of ANA in 2000. Air Do had difficulties to increase services on this route because they were not able to acquire enough aircraft due to lack of capital. After having the management control of ANA, Air Do leased the aircraft from ANA and increased frequencies on this route (see Figure 6.14). This meant the end of competition between a new entrant and network carriers on this route. It affected fares markedly. In 2001, the difference between the highest fare and the lowest fare was about 43% on the Tokyo-Sapporo route. The highest fares dropped 10% in 2003, but from that year the difference between fares became only 20-29%, which is almost the same as in other duopoly markets operated by JAL and ANA. Air Do changed its role from a competitive new entrant to a quasi low-cost subsidiary of ANA.

Figure 6.13: Number of passengers carried on the Tokyo-Sapporo route from 1985 to 2005



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1985-2005)

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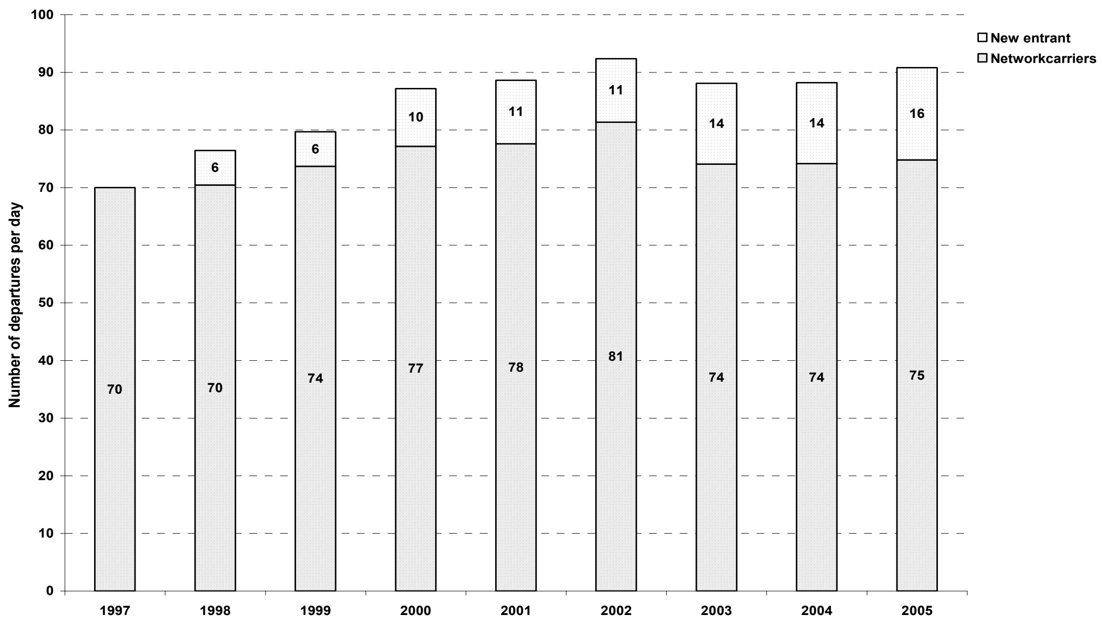
26 This law was established to revitalise Japanese companies that, although having valuable management resources, are unable to move forward because of excessive debt. The Industrial Revitalization Corporation of Japan (IRCJ) purchases the debt of concerned companies and assists the revitalisation of individual businesses by providing financial assistance and external advice for their operation. In the Skynetasia case, the IRCJ owned 57% of the shares by JYE3.4 billion capital injections and appointed ANA as an operative cooperation company by transferring 14.99% of the shares to ANA from IRCJ. Although IRCJ owns 42% of the shares, in order to remain in the management. ANA influences the management as a key shareholder.

Figure 6.14: Number of departures per day on the Tokyo-Sapporo route from 1997 to 2005

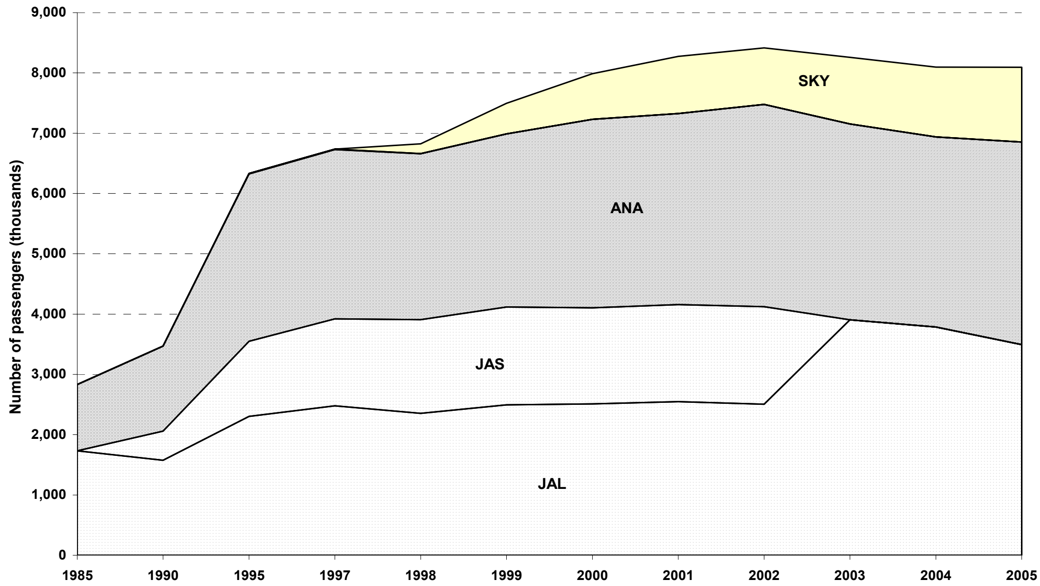


Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2005)

A similar situation has been experienced on the Tokyo-Fukuoka route (Category 1, 1,141kms). This air transport dominating route also increased demand during 1985 to 1996 because of the effects of deregulation. Frequency was increased from about 62 per day in 1997 to 90 per day in 2004 since Skymark started operation in 1998, offering half the fare of network carriers' fares. However, pricing competition was intense on this route and network carriers started to provide exactly the same prices on the flights which departed at similar times as Skymark. Skymark kept about 80% load factors in 1998 and dropped to 65.5% in 2000 as a result.

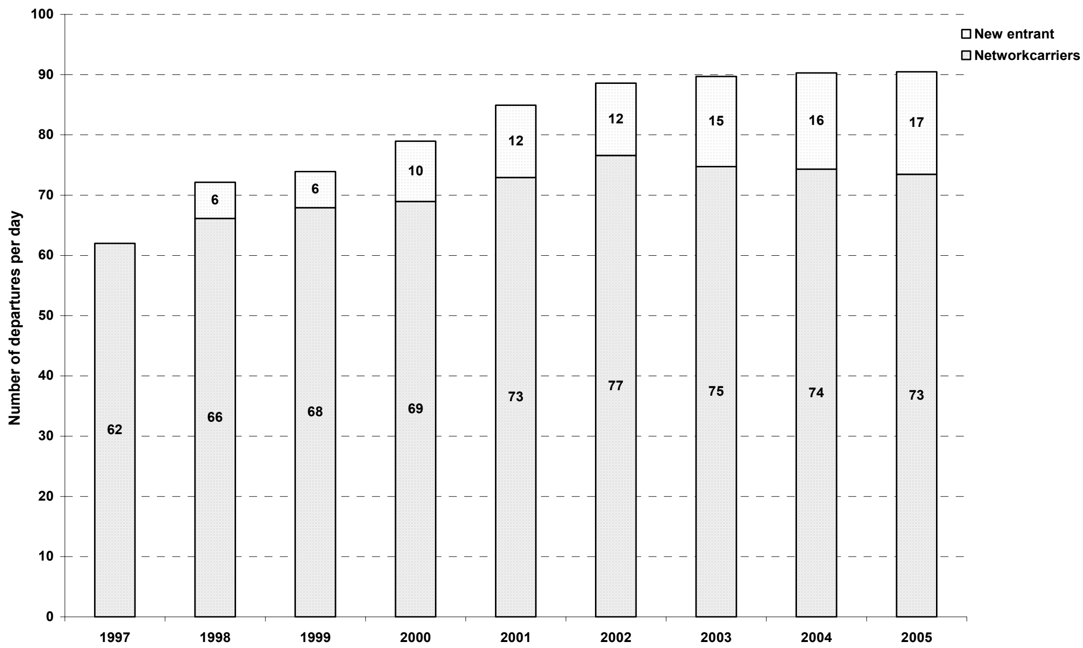
After liberalisation in 2000, the number of passengers carried on this route increased 4%, the lowest fare decreased 7.7% in 2001, and the highest fare dropped 10%, although other discounted fares increased 5-10%. However, in 2004 all types of fares increased between 11.1% and 26.3%, even after the new entrant came into this market, while the load factor dropped from 64% in 1999 to 60%. Traffic volume increased only 20% from 6.7 million in 1997 to 8.1 million in 2004. Therefore, discount fares have not been attractive enough to stimulate potential demand and Figures 6.15 and 6.16 clearly demonstrate that the market has already become saturated (see Table 6.18).

Figure 6.15: Number of passengers carried on the Tokyo-Fukuoka route from 1985 to 2005



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1985-2005)

Figure 6.16: Number of departures per day on the Tokyo-Fukuoka route from 1997 to 2005



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2005)

Table 6.18: Example routes of new entrants, Skymark and Air Do, during the process of the slot allocation system: Tokyo-Sapporo and Tokyo-Fukuoka routes

		% increase in number of passengers	Load factor (%)	HHI	(a) Max fare USD (JYE)	(b) Discount Max USD (JYE)	(c) Lowest fare USD (JYE)	% increase in (a)	% increase in (b)	% increase in (c)	The % difference of (a) & (c)
SPK (894km)	**2001**	4.29	67.7	0.30	221.69 (28,000)	174.19 (22,000)	95.0 (12,000)	0.00	0.00	-7.69	0.57
	2003	-3.7	64.3	0.42	213.0 (25,200)	186.0 (22,000)	76.1 (9,000)	-10.0	0.00	0.00	0.64
	2004	-1.57	66.1	0.42	269.2 (28,000)	230.8 (24,000)	96.1 (10,000)	11.1	9.09	11.1	0.64
FUK (1,041km)	**2001**	3.57	63.7	0.30	245.4 (31,000)	190.0 (24,000)	78.4 (9,900)	0.00	0.00	-10.0	0.68
	2003	-1.88	59.4	0.41	235.8 (27,900)	177.5 (21,000)	82.8 (9,800)	-10.0	5.0	10.1	0.65
	2004	-1.96	60.5	0.40	298.1 (31,000)	254.8 (26,500)	105.8 (11,000)	11.1	26.2	12.4	0.65

Sources: Japanese Airlines' timetables (JAL, JAS, ANA, SKY, ADO) in April 2001 to 2004 and Ministry of Land, Infrastructure and Transport, Aviation statistics (2001- 2004).

Notes: These exchange rates adopted are the Representative Rates for Selected Currencies, which were reported in the exchange rate archives by month of the International Monetary Fund in April, 2001, 2003 and 2004.

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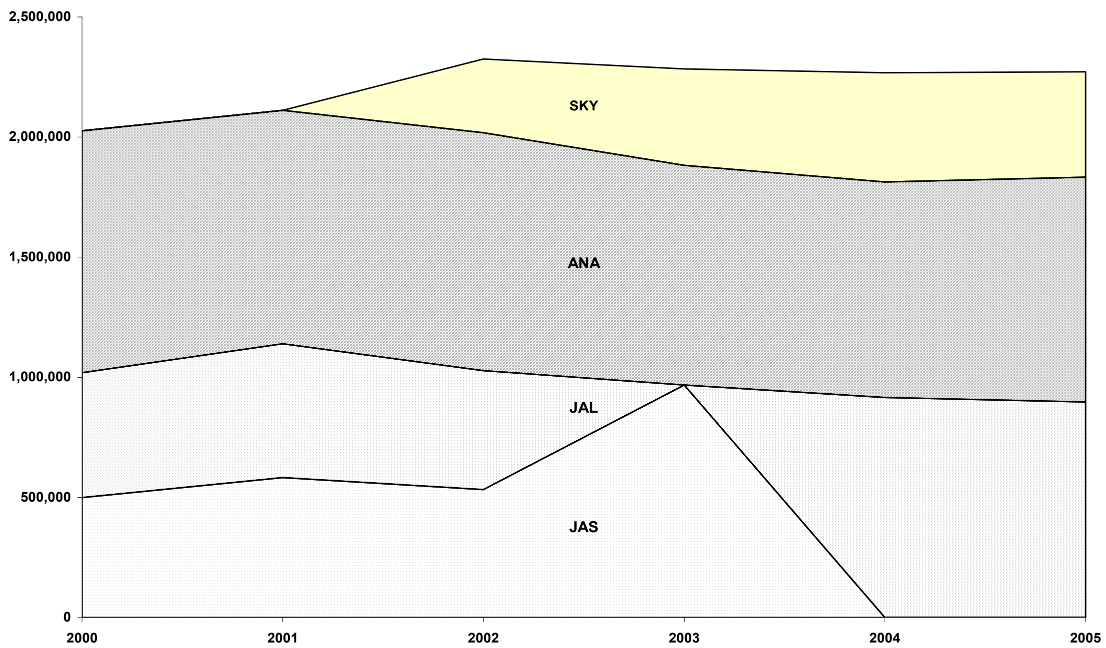
Skymark tried to develop other high demand routes such as the Tokyo-Kagoshima route (1,111kms), one of the strong VFR markets in category 2. All types of fares were dropped in 2003 after Skymark started operating in 2002 with a strong support by local companies in the Kagoshima area. However, traffic volume did not increase significantly and average load factor dropped from 62% in 2000 to 56% in 2005 and all fares subsequently increased even though some discounted fares were 50% cheaper than in 2001 (see Figures 6.17 and 6.18). Skymark entered with some low discount fares to attract both business and VFR traffic. However, these fares were not sufficiently cheap to encourage additional demand, especially potential VFR traffic. Because of this, on some of these routes traffic volume by automobiles increased 20% in 2003 over the previous year. Their products (not only fares but also reliability, branding and flight schedule, etc[27]) were not sufficiently attractive to increase VFR demand while competing with network carriers.

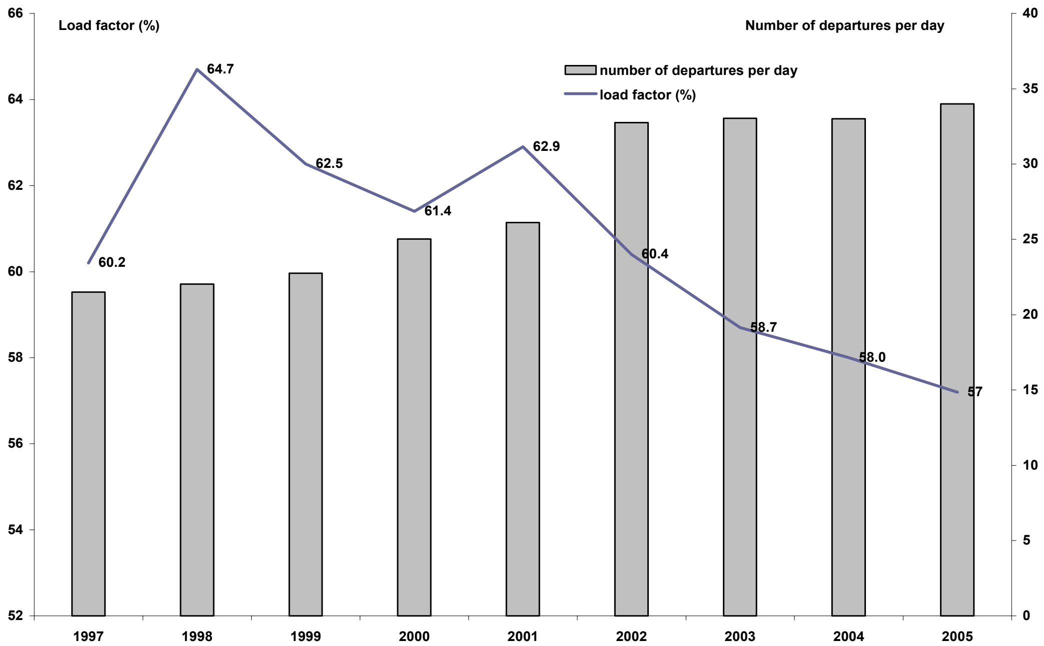
Figure 6.17: Number of passengers carried on the Tokyo-Kagoshima route from 2000 to 2005



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (2000-2005)

[27] Skymark often cancelled flights because of the lack of spare aircraft and several problems caused by safety and pilot issues.

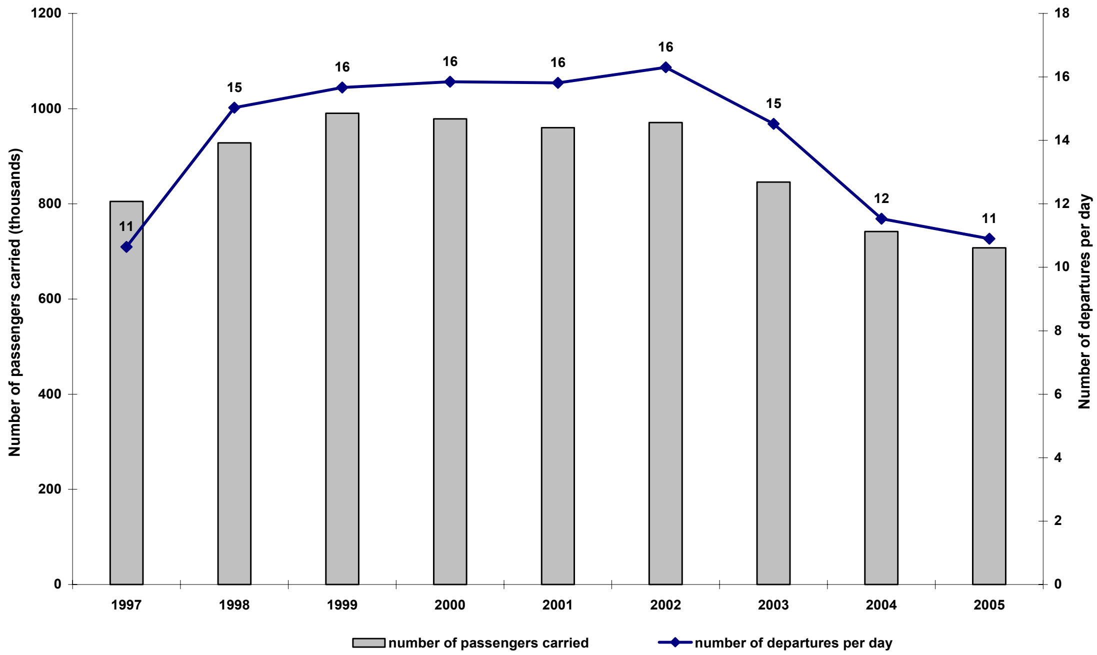
Figure 6.18: Number of departures per day and average load factors on the Tokyo-Kagoshima route from 1997 to 2005



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2005)

Skymark's strategy became increasingly unclear. On the Tokyo-Aomori route (Category 4, 690km), the market demand and frequency were developed after the Phase I Slot Allocation at Haneda airport in 1997. Because high speed rail started services on this route in 2002, ANA planned to leave this route (c.f. supra, chapters 4 and section 6.4 of this chapter). In 2003, Skymark entered this route by leasing an ANA B-767 aircraft to replace ANA services while offering a 20-40% discount fare. However, the market was very small and only 40% discount was not attractive enough to increase demand while competing with HSR. In the following year, Skymark closed this route, which became a monopoly market by JAL. Frequency dropped 30% from 16 in 1998 to 11 per day in 2004. The number of passengers carried was 900,000 in 1999 and decreased by 22% to 700,000 in 2005 as a result (see Figure 6.19). Skymark experienced the same kinds of failure on the Tokyo-Tokushima route as well.

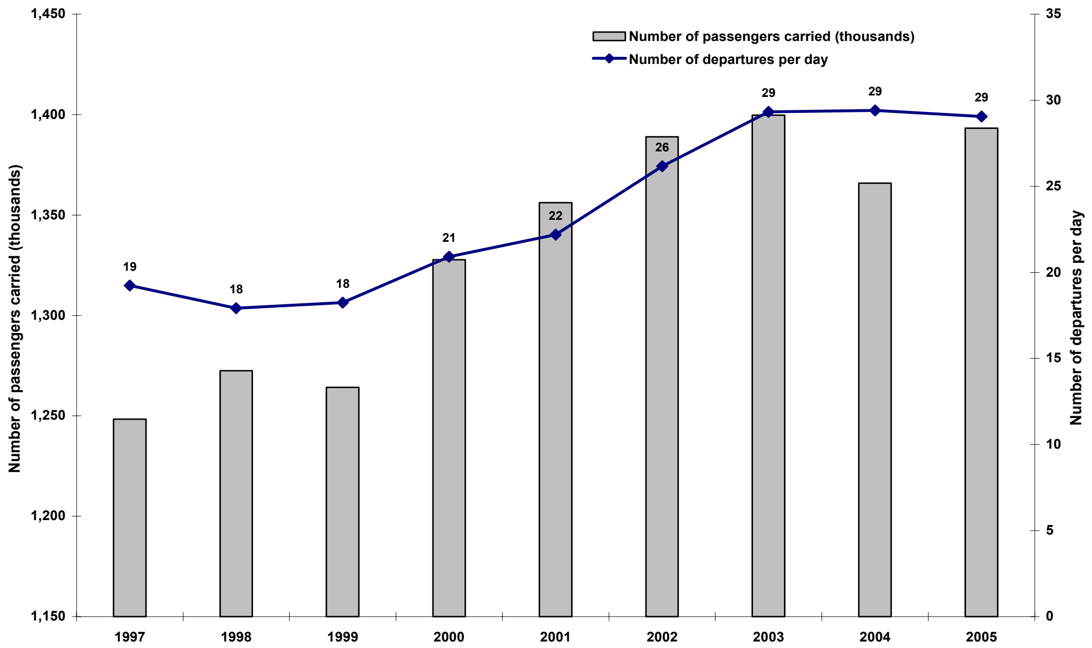
Figure 6.19: Number of passengers carried and departures per day on the Tokyo-Aomori route from 1997 to 2005



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2005)

On other routes, another new entrant, such as Skynetasia, was not successful either.Figure 6.20 shows the annual number of passengers carried and the number of departures per day on the Tokyo-Miyazaki route from 1997 to 2000. The number of departures per day increased from 19 in 1997 to 29 in 2004 as a result of Skynetasia's entry on the Tokyo-Miyazaki route (Category 3, 1,023kms) in 2003. The traffic volume increased a little by 0.78% over the previous year in 2003. Even though cheap discount fares (USD 72-90) were offered by Skynetasia, they did not enable the development of the market and the fully flexible fares increased in 2005 to higher levels than those of 2000. Skynetasia strongly believed that high freaquencies increased demand on the route and persisted with this policy. However, frequency of 29 departures per day was too much for this catgegory 3 market to deliver appropriate load factors for low cost carriers. Moreover, Skynetasia experienced huge financial trouble because of the lack of sound business management. Although Skenetasia had strong support by local industries and government, the airline became governed by the Industrial Revitalisation Cooperation Act (IRCA) with managenent support from ANA in 2004 as was implemented for Air Do in 2000. In 2005, the fully flexible fares returned to the same level (USD 290) as those of 2000 on this route as a result.

Figure 6.20: Number of passengers carried per year and departures per day on the Tyo-Miyazaki route from 1997 to 2005



Source: Author based on the data from Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2005)

All routes where new entrants entered after deregulation experienced similar patternes. In the beginning, the market was developed a little by increased frequencies and discounted fares offered by new entrants. Competition among airlines seemed to be experienced in the market. This situation was not sustainable and new entrants started to suffer not only big financial problems but also changed their managements and strategies, especially on network development issues. As a result, most new entrants became governed by the IRCA and under the control of ANA. This affected the market, which resulted in fares to increase and demand to drop, notably on the low demand routes such as categories 4 and 5 routes. These results affect local economic activities and aggravate economic stagnations in the regions because most new entrants are supported by companies and government in the local regions.

Interestingly, these new entrants have been able to keep “New entrant slots” at Haneda airport, even after ANA gained management control. New entrants keep and request the new entrant slots while network carriers own the new entrants shares (upto 20%) and provide human resourses in the new entrants’ management teams. ANA provides also distribution services via ANA’s reservation centres. In fact, all those new entrants’ network strategies and fares are decided under the control of ANA and these new entrants continue operation and functions as de facto subsidiary airlines of ANA to operate relatively low demand routes.

Skymark entered an appeal to a court against this situation, in particular, Air Do keeping “New entrants slots” in December 2004. Skymark claimed against Minister of Land, Infrustructure and Transportation that this situation acted in violation of the competition law. However, Skymark’s appeal was dismissed in April 2006.

The insignificant effects of new entrants on the market and their failures were demonstrated in this section. The reasons of new entrants’ failures are analysed by focusing on the Skymark case in chapter 9.

Table 6.19: Effects of new entrant, Skymark, during the process of the slot allocation system; Tokyo-Kagoshima route

	% increase in number of passengers	**Load factor (%)**	**HHI**	**(a) Max fare USD (JYE)**	**(b) Discount Max USD (JYE)**	**(c) Lowest fare USD (JYE)**	**% increase in (a)**	**% increase in (b)**	**% increase in (c)**	**The % difference of (a) & (c)**
2001	4.23	62.9	0.37	261.3 (33,000)	162.3 (20,500)	162.3 (20,500)	0.00	20.6	20.6	0.38
2003	-1.78	58.7	0.38	251.1 (29,700)	164.8 (19,500)	77.6 (9,800)	-10.0	-4.88	10.1	0.67
2004	-0.7	58.0	0.36	319.2 (33,200)	254.8 (26,500)	105.8 (11,000)	11.1	35.9	12.2	0.67
2005			0.42	311.1 (33,600)	250.9 (27,100)	101.8 (11,000)	1.1	2.2	0.0	0.67

Sources: Japanese Airlines' timetables (JAL, JAS, ANA, SKY) in April 2001 to 2005 and Ministry of Land, Infrastructure and Transport, Aviation statistics (2001- 2005)

Notes: These exchange rates adopted are the Representative Rates for Selected Currencies, which were reported in the exchange rate archives by month of the International Monetary Fund in April, 2001, 2003, 2004 and 2005.

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6.7 Summary

During the process of the slot allocation system and liberalisation, the structure of airlines in Japan changed dramatically. JAL and JAS were consolidated, while ANA had a leasing contract with Skymark for its operations on new routes to Aomori and Tokushima. Skymark also had a codesharing operation with JAL on the Tokyo- Kansai route. None of the new entrants could utilise the chance to expand their businesses using New entrant slots (c.f. supra, chapter 5). Air Do and Skynetasia were subjected to the control of ANA being under the Industrial Revitalisation Cooperation Act from 2000 and 2007.

The average fully flexible fares were higher in 2005 compared to 2000. The highest discount fares and new entrants' fares became only around 30% lower than the fully flexible fares. The differences between the fully flexible fares and lowest discount fares were around 50% even in the high demand categories 1 and 2 markets. On some routes the lowest discounted fares stimulated demand, for example, on the Tokyo-Hiroshima, Fukuoka, Komatsu routes and on several new routes like Tokyo-Toyama and Okayama, as a result of competition with surface transportation, especially high speed rail. In competitive markets with good surface transportation like the category 2 routes, the fully flexible fares have not risen and the discount fares are 20% lower than in 2000. This is the effect of competition with high speed rail in this category. However, on other low demand routes like categories 3, 4 and 5, the lowest discount fares were increased by more than 20% to 35%, although the fully flexible fares were lowered by 2%. As frequencies have decreased in category 5 routes, passenger demand is less after five years of deregulation with an average of 45,000 passengers on each route annually.

The key objectives of the slot allocation policies were the promotion of competition and the improvement of consumers' convenience with safety assured. It would appear as a result of this market analysis that these objectives have not yet been accomplished. Airlines have strong voices not only for making policies but also among industries and society. Even under the competition promotion policy after liberalisation, airlines are able to set exactly same fares as other airlines on the routes. Most new entrants became de facto subsidiary airlines of ANA and they can keep their new entrants slots. Real competition like other regions in the world has not occurred in the Tokyo domestic market. This is because the industry structure, customs and culture in the Japanese airline industry including Government, who have been extremely reluctant to experience strong competition. Especially the so-called “Huddling culture” among airlines has been a big obstacle for competition.

The slot allocation policy of 2005 (Phase III) has been acted upon in 2006. JAL and Skymark have faced safety issues, which have been recognised to be caused mainly by organisational problems. A new start-up airline in 2006, Starflier, had received a warning from JCAB because of operation manual violation only two months after its first flight.

The routes from Tokyo have become very competitive sectors not only between airlines but also high-speed railways. Both airlines and high-speed railways, which want to increase profit in these markets, inject their business assets more on these sectors and keep fares high. Competition occurs in terms of service frequency and product quality rather than through cheap fares. In addition, relatively low demand markets like route categories 3, 4 and 5 do not seem to participate in this market development with fares increasing more and more. These markets have experienced decreasing frequencies and demand, and stagnancy of the local economies. On the other hand, in these markets air transport has a significant advantage over surface transportation in terms of distance and infrastructure.

Three prominent results of liberalisation were found during the process of the slot allocation system: (1) decreased demand, (2) increased fares and (3) new entrants’ failures. All of these results are different from the experiences of other countries after deregulation. The result of this slot allocation system has indicated important suggestions for competition policymaking. It is clear that there are several constraints for competition in the domestic market in Japan (see Tables 6.20 and 6.21)

In the next chapter 7, comparative analysis with the UK domestic and intra-EU market serving the UK is undertaken to demonstrate the different experiences between these two markets.

Table 6.20: The results of deregulation by market category in 2003 over 2000

	The Tokyo routes (%)						General Experiences in the US and EU market
Category	**1**	**2**	**3**	**4**	**5**	**6**	
Traffic volume	12	- 1	12	8	- 13	4	Increase
Frequency	15	16	30	12	- 46	- 3	Increase
Load factor	- 4	- 6	- 4.4	- 4	4	- 7	Increase
Highest fares	-10	-10	- 9	- 8	- 3	- 5	Decrease
Highest discount fares	0	2	10	- 3	7	26	EU data not available
Lowest fares	9.9	- 22.3	5	2	18	24	Decrease

Table 6.21: The results of deregulation by market category in 2000 over 1997

	The Tokyo routes (%)						General Experiences in the US and EU market
Category	**1**	**2**	**3**	**4**	**5**	**6**	
Traffic volume	22	21	8	6	- 5	6	Increase
Frequency	33	29	8	12	- 7	- 8	Increase
Load factor	- 3	- 1	0	- 4	- 7	- 3	Increase

Notes: Each number refers to the ratio of 2003 over 2000 and that of 2000 over 1997 by category, which is computed using the results. (See Appendix H and Appendix J)

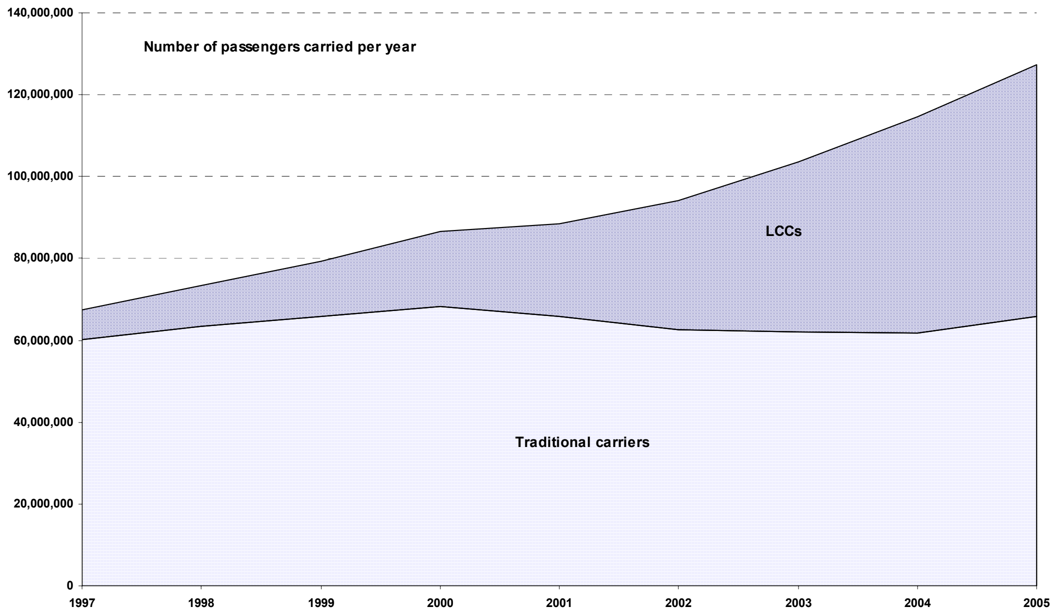
Chapter 7: Comparative analysis between the Tokyo routes and a selection of routes in the intra-European market

7.1 Introduction

In chapter 7 several individual routes in the intra-European market, which are serving in countries in the European Union, are analysed using the same factors used in chapter 6. The routes are categorised according to the same scale as used for the Tokyo routes market using UK CAA data for 2000. This data only includes the scheduled flights on intra-European routes serving the UK and those serving the UK domestic market. All of the top 30 routes of categories 1, 2 and 3 and several routes of the categories 4 and 5 markets are analysed using UK CAA data from 1997 to 2005 in order to focus on the level of demand, frequency, load factor, the number of airlines and airports on individual routes and to investigate in detail how they have changed over time. Fares have been excluded from the analysis because of the limitation of publicly available fare data in the intra-European market. The category 6 routes serving remote islands are removed in order to draw attention to the traditional carriers and LCCs activities in this analysis. The outcomes of these analyses are compared with the results of the Tokyo route market analysis (supra, chapter 6) in order to demonstrate the characteristics of the European market after deregulation and the differences with the Tokyo routes market.

In Europe, the process of liberalisation was started in 1986 and the air transport market has seen significant developments since the European Commission published the third package of liberalisation proposals in 1992. Figure 7.1 shows the growth of the intra-European market serving the UK and the UK domestic market from 1997 to 2005 and the impact of LCCs on the market. The total number of passengers reached more than 120 million in 2005 and increased by 1.8 times from 67.3 million in 1997. The number of passengers carried by LCCs has increased by about 31% per year on average between 1997 and 2005, and the market share of LCCs has increased to 48% in 2005 compared with 10% in 1997, while the traditional carriers' traffic grew only by an average 1% over the previous year.

Figure 7.1: The total numbers of passengers carried in the intra-European market serving the UK and on UK domestic routes (1997- 2005)



Source: UK CAA (1997-2005)

7.2 Categories 1 and 2 routes in the intra-European market serving UK and UK domestic routes

Table 7.1 shows the top 20 sectors of the intra-European routes serving the UK in 2000 and segmented by category, which is a similar approach to that used for the Tokyo routes analysis (supra, chapter 3).

The category 1 routes of the intra-European market are summarised in Table 7.2 and compared with the Tokyo routes. The combined numbers of passengers on 4 category 1 routes from the UK are about the same as the sum of the top 2 Tokyo routes, Tokyo-Sapporo and Tokyo-Fukuoka. The average number of departures per day was 95 for the category 1 UK-intra-European routes compared with 58 for the category 1 Tokyo domestic routes. This highlights three significant characteristics of the Tokyo domestic market: (1) the size of the Tokyo routes is larger than the largest UK routes, (2) despite this fact, these routes are operated at lower frequency by larger aircraft, and (3) this can be explained by the scarcity of slots and non-existence of secondary airports serving Tokyo.

Table 7.1: Examples of intra-European routes serving the UK and UK domestic routes by category in 2000

Category	Route	Number of passengers per year	Number of departures per year/day	Supplied seat capacity per year	Average capacity per departure	Average load factor (Low cost) %	Average load factor (Traditional) %	Average load factor%
1	DUB-LON	4,383,287	39,765	5,763,274	145	76	76	76
1	AMS-LON	3,895,212	42,555	5,333,556	125	80	72	73
1	EDI-LON	3,032,737	29,184	4,297,747	147	71	70	71
1	LON-PAR	3,012,981	33,867	4,866,503	144	-	62	62
1	GLA-LON	2,880,517	28,428	4,159,421	146	74	67	69
	Average	**3,440,947**	**34,760/95**	**4,884,100**	**142**	**75**	**69**	**70**
2	FRA-LON	2,350,892	21,883	3,713,972	170	65	63	63
2	LON-MAN	2,059,076	20,545	3,046,275	141	68	68	68
2	BFS-LON	1,937,997	18,938	2,747,205	145	73	69	71
2	LON-ZRH	1,780,027	20,001	2,931,620	147	76	59	61
2	LON-MAD	1,739,002	15,829	2,754,557	174	72	61	63
	Average	**1,973,399**	**19,439/53**	**3,038,726**	**155**	**71**	**64**	**65**
3	LON-ROM	1,687,365	14,116	2,446,192	173	77	68	69
3	LON-MIL	1,651,257	18,497	2,853,909	154	63	57	58
3	BRU-LON	1,493,603	23,213	2,918,004	136	-	52	52
3	CPH-LON	1,457,598	15,319	2,337,477	153	63	62	62
3	GVA-LON	1,456,840	14,787	2,318,740	157	75	58	63
3	LON-STO	1,417,820	13,085	2,153,585	165	68	65	66
3	LON-MUC	1,359,873	12,271	2,010,506	164	64	68	68
3	BCN-LON	1,344,631	11,152	1,796,533	161	82	71	75
3	LON-NCE	1,068,000	8,772	1,449,517	165	79	71	74
3	ATH-LON	1,022,295	7,340	1,425,162	194	82	70	72
3	AMS-MAN	922,370	14,033	1,586,525	99	80	53	58
3	DUB-MAN	814,322	11,359	1,171,574	102	67	73	70
	Average	**1,330,263**	**14,035/38**	**2,070,300**	**152**	**72**	**62**	**64**

Source: Author based on UK CAA data (2000)

Table 7.2: The characteristics of category 1 intra-European routes serving the UK and UK domestic routes compared with the Tokyo routes in 2000

Category	Routes From A to B	Number of passengers per year	Number of departures per year/day	Average capacity per departure	Number of Traditional carriers	Number of LCC	Competition with HSR	Number of airports at A	Number of airports at B	Average load factor
1	LON-DUB	4,383,287	39,765/109	145	3	2		5	1	76%
1	LON-AMS	3,895,212	42,555/116	125	5	1		5	1	73%
1	LON-EDI	3,032,737	29,184/80	147	4	3		5	1	71%
1	LON-PAR	3,012,981	33,867/93	144	5	0	X	5	2	62%
1	LON-GLA	2,880,517	28,428/78	146	4	2		5	1	69%
	Average	**3,440,947**	**34,760/95**	**142**	**4**	**1.6**		**5**	**1**	**70%**
1	TYO-SPK	8,898,882	30,375/83	294	3	1		1	1	66%
1	TYO-FUK	7,752,652	28,711/79	271	3	1	X	1	1	63%
1	TYO-OSA	4,320,154	13,004/36	336	3	0	X	1	1	71%
1	TYO-OKA	3,815,422	12,948/35	296	3	0		1	1	72%
	Average	**6,196,778**	**21,675/58**	**299**	**3**	**0.5**		**1**	**1**	**68%**

Source: Author based on the data from UK CAA (2000) and Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Note: High speed rail (HSR) refers to train services with a speed of more than 250 kms/ hour.

These characteristics of the Tokyo routes market are highlighted more clearly in the category 2 market. The number of departures per day was 25 on the Tokyo routes and 55 on the European routes (see Table 7.3). In 2000, the total number of passengers in route categories 1 and 2 in Japan (8 routes), which was about 33 million, was equivalent to the total number of passengers on the top 15 routes in Europe. The categories 1 and 2 markets of the Tokyo routes carry a very large number of passengers, although only two traditional carriers (Japan Airlines and All Nippon Airways) operated most of the flights on these 8 routes in 2000.

Table 7.3: The characteristics of category 2 intra-European routes compared to Tokyo routes in 2000

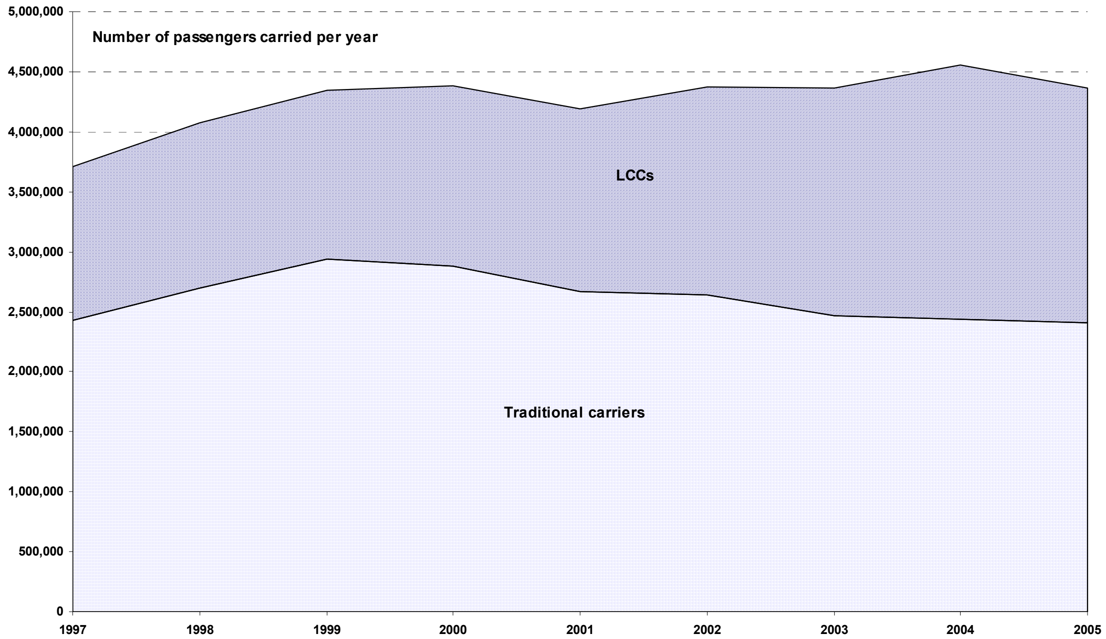
Category	Routes From A to B	Number of passengers per year	Number of departures per year/day	Average capacity per departure	Number of Traditional carriers	Number of LCC	Competition with HSR	Number of airports A	Number of airports B	Average load factor
2	LON-FRA	2,350,892	21,883/60	170	4	1		5	2	63%
2	LON-MAN	2,059,076	20,545/56	141	2	2	X	5	4	68%
2	LON-BFS	1,937,997	18,938/52	145	2	3		5	2	71%
2	LON-ZRH	1,780,027	20,001/55	147	2	1		5	2	61%
2	LON-MAD	1,739,002	15,829/43	174	3	3		5	1	63%
	Average	**1,973,399**	**19,439/53**	**155**	**2.6**	**1.4**		**5**	**2**	**65%**
2	TYO-KIX	2,325,985	10522/29	344	3	0	X	1	1	64%
2	TYO-HIJ	2,231,196	9,916/27	345	3	0	X	1	1	65%
2	TYO-KOJ	2,025,747	9,134/25	361	3	0		1	1	61%
2	TYO-KMQ	2,021,863	7,609/21	381	3	0		1	1	70%
	Average	**2,151,198**	**9295/26**	**356**	**3**	**0**		**1**	**1**	**65%**

Source: Author based on data from UK CAA (2000) and Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Note: High speed rail (HSR) refers to train services with a speed of more than 250kms/hour.

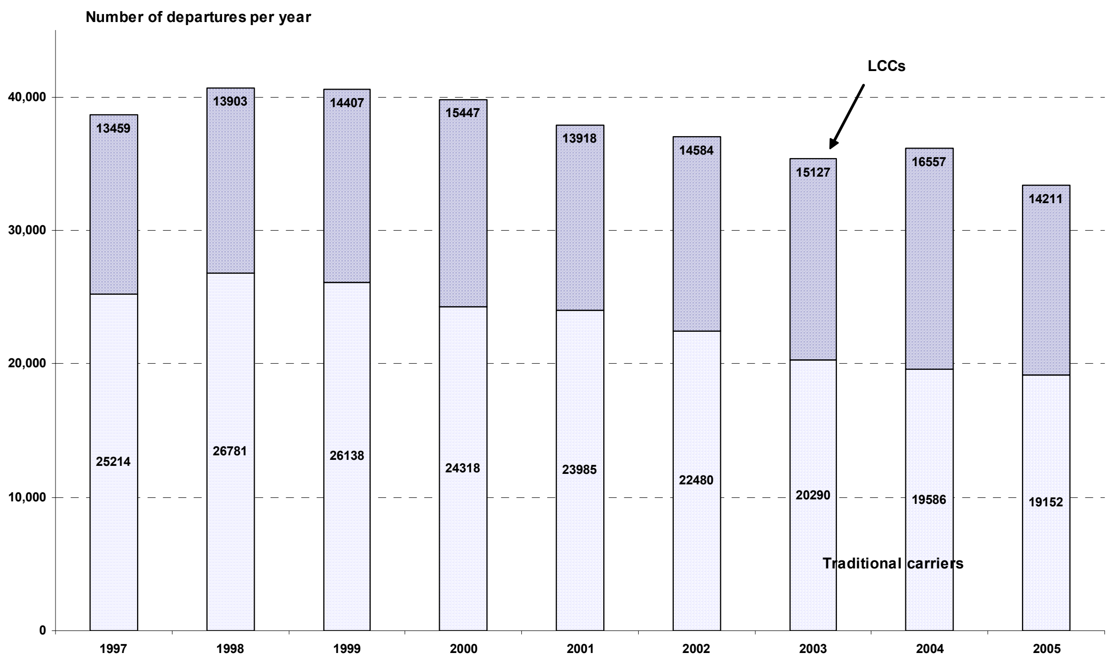
On the busiest route serving the UK, London-Dublin, the number of passengers increased by 1-10% per year from 1997 to 2005, although it dropped by 4% in 2001. The market was shared out 35% to LCCs and 64% to traditional carriers in 1997, and 45% to LCCs and 55% with traditional carries in 2003. With market liberalisation, airlines tried to increase frequency in order to increase their market share. However, both LCCs and traditional carriers reduced their frequencies from 2001 on this busiest sector in order to adjust the balance of supply and demand (see Figures 7.2 and 7.3). The share of departures between low cost carriers and traditional airlines was almost same as the market share of the two, with LCCs accounting for 35% in 1997 and 43% in 2003 and traditional carriers 65% in 1997 and 57% in 2003.

Figure 7.2: Number of passengers on the London-Dublin route from 1997 to 2005



Source: UK CAA (1997-2005)

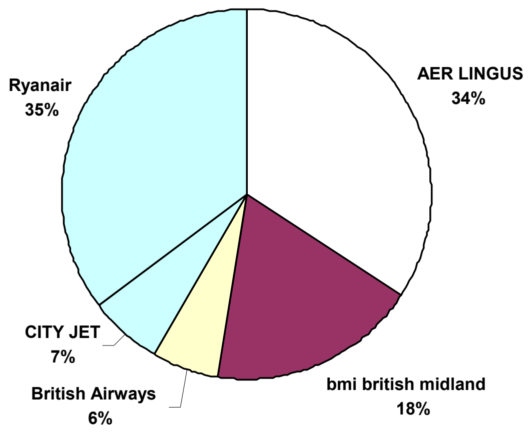
Figure 7.3: Number of departures on the London-Dublin route from 1997 to 2005



Source: UK CAA (1997-2005)

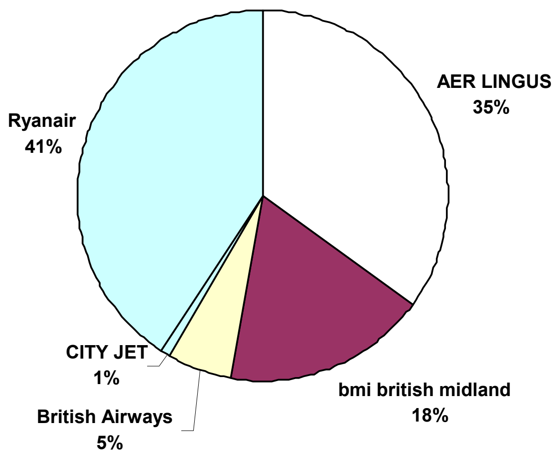
On the London-Dublin route traffic increased by 8% as a result of a strong LCC, Ryanair, which increased its market share from 35% in 1997 to 41% in 2000. Figures 7.4 and 7.5 show the competitive situation between Aer Lingus and Ryanair on this sector.

Figure 7.4: The share of seat capacity on London-Dublin in 1997



Source: UK CAA (1997)

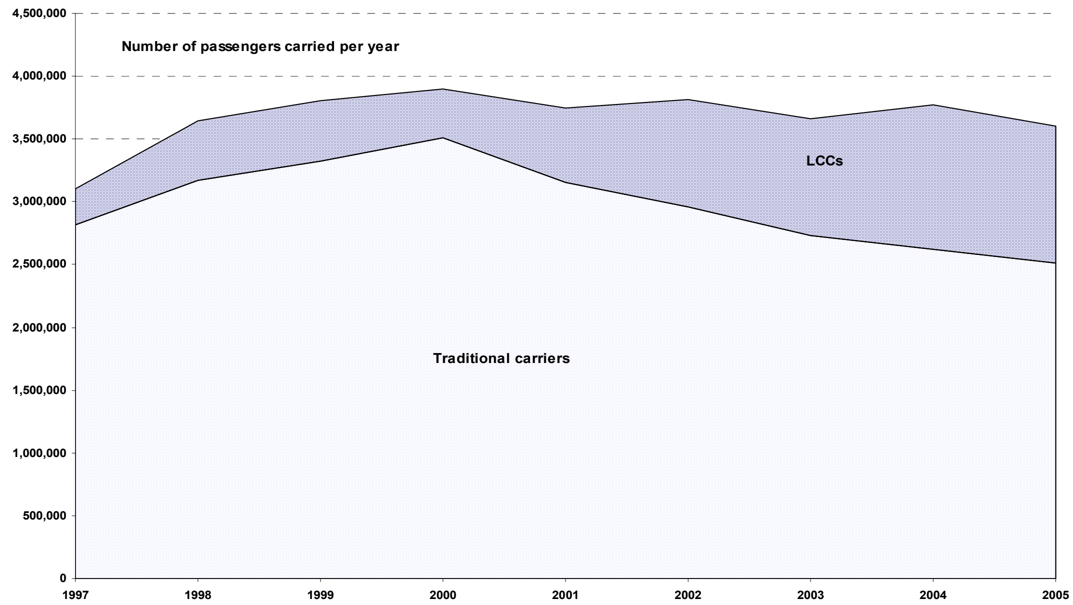
Figure 7.5: The share of seat capacity on London-Dublin in 2000



Source: UK CAA (2000)

Another busy route, London-Amsterdam, where traditional carriers occupied 90% of the market in 1997, was also affected by LCCs. In 2000, the market share of LCCs was increased by more than 50% over the previous year, reaching 30% in 2005. EasyJet's market share was only 2% in 1997, but increased to 21% in 2003 and became 25% in 2005 compared with 25% for British Airways and 26% for KLM. This shows how the strong European LCCs have been able to achieve an important position when competing with traditional carriers on a route (see Figure 7.6).

Figure 7.6: Number of passengers carried on London-Amsterdam from 1997 to 2005



Source: UK CAA (1997-2005)

Load factors of key players on these routes were relatively high; that of easyJet was about 80% and KLM maintained around 78% on the London-Amsterdam route (see Table 7.4.)

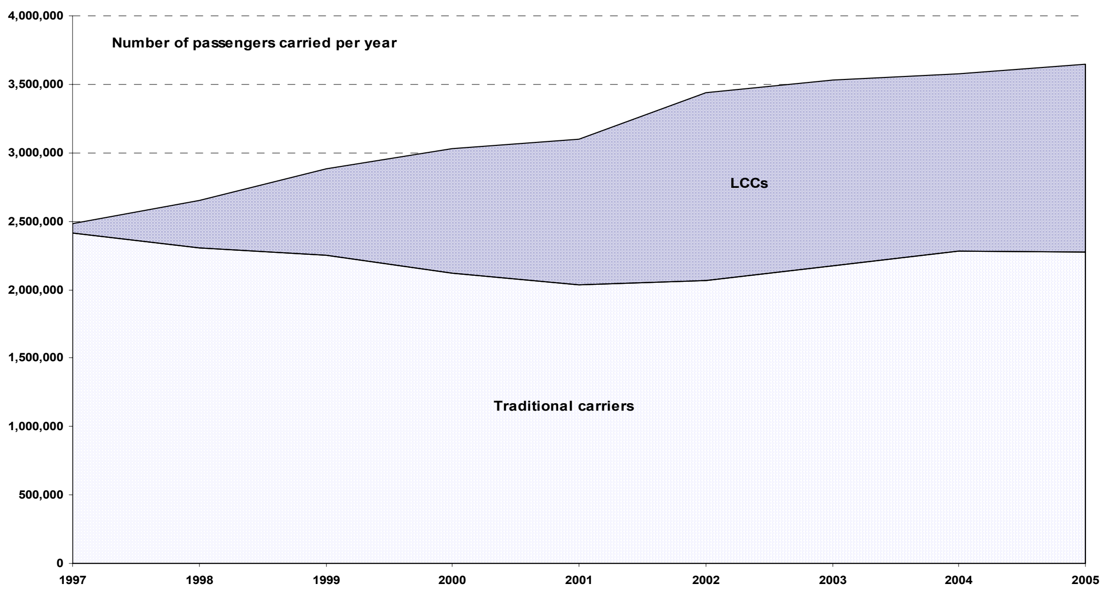
Table 7.4: Average load factors of key players on the London-Amsterdam/Rotterdom route

	1997	2000	2003	2005
BMI British midland	73%	76%	67%	68%
British Airways	68%	68%	68%	59%
EasyJet	72%	80%	81%	80%
KLM	76%	77%	78%	78%
Transavia	67%	-	70%	51%
VLM	59%	62%	52%	55%

Source: Author based on data from UK CAA (1997-2005)

Williams (2002) mentioned that in the initial phases of LCC development, they had been concentrating mainly on the London-Scotland trunk market, the London-Edinburgh and London-Glasgow, both category 1 routes. Figure 7.7 demonstrates the substantial impact of LCCs on the London-Edinburgh route. Demand increased to 3.5 million passengers in 2005 from 2.5 million in 1997, whilst the market share of traditional carriers in 1997 was 97% and falling to 60% in 2000 as a result of the increased frequencies by LCCs.

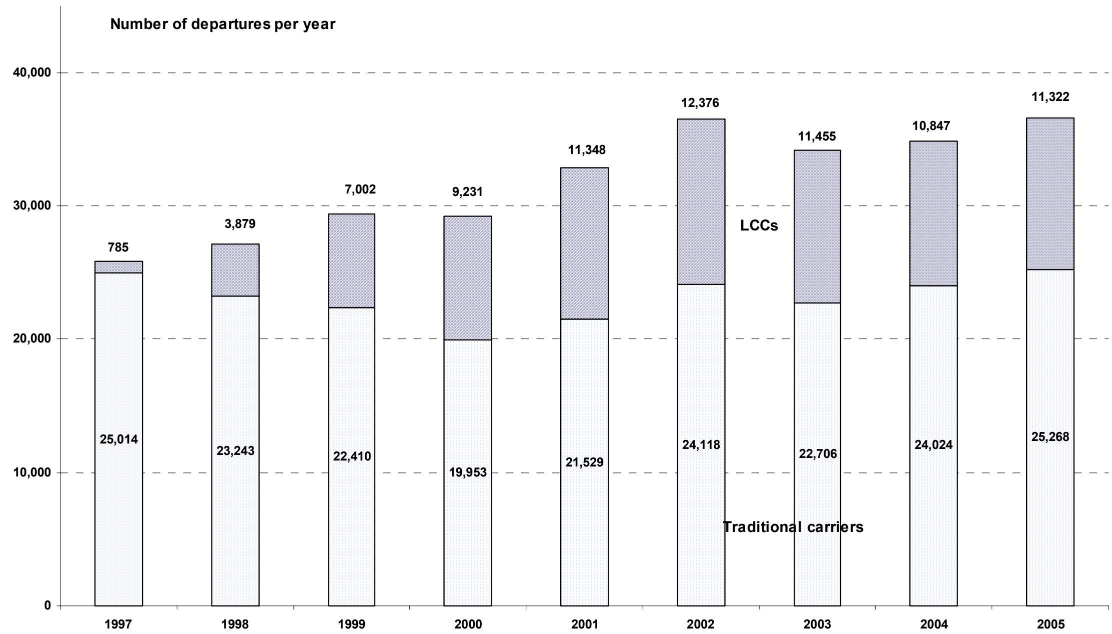
Figure 7.7: Number of passengers on London-Edinburgh from 1997 to 2005



Source: UK CAA (1997-2005)

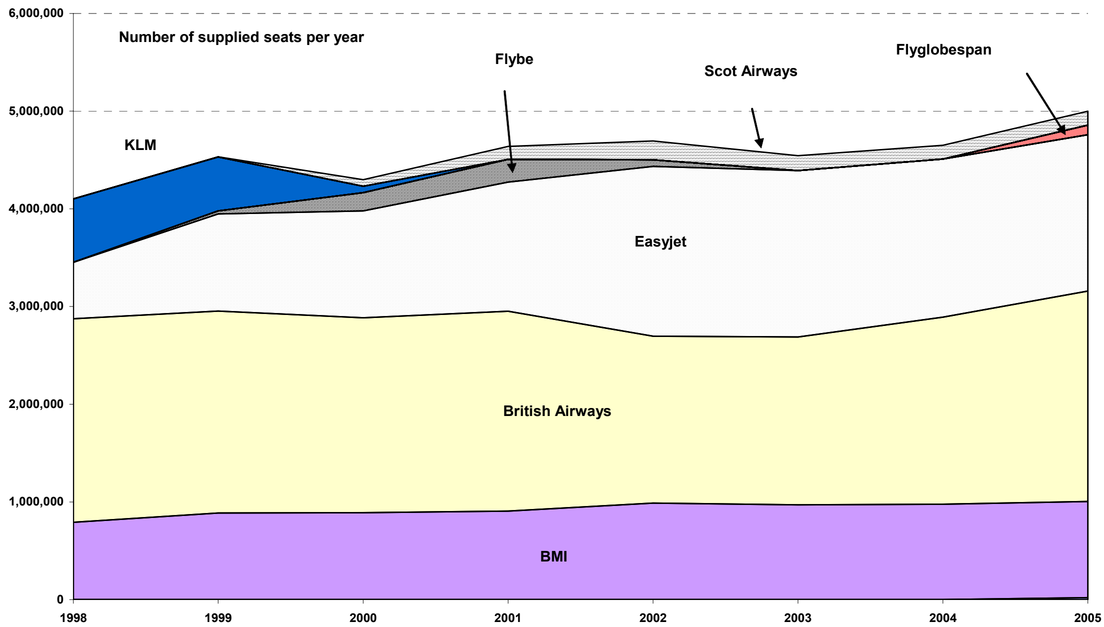
EasyJet gradually increased seat capacities on the London-Edinburgh route and in 2000 provided a total of 1.7 million seats, which was more than British Airways' supply. From 2003, easyJet slightly decreased frequency, while keeping high average load factors (80%) and a strong market share (36%) compared with the two traditional carriers' share (61%). British Airways and BMI British Midland tried to maintain their market shares by increasing frequency and average load factors (British Airways: 68% in 1997, 80% in 2003) (see Figures 7.8 and 7.9).

Figure 7.8: Number of departures on the London-Edinburgh route



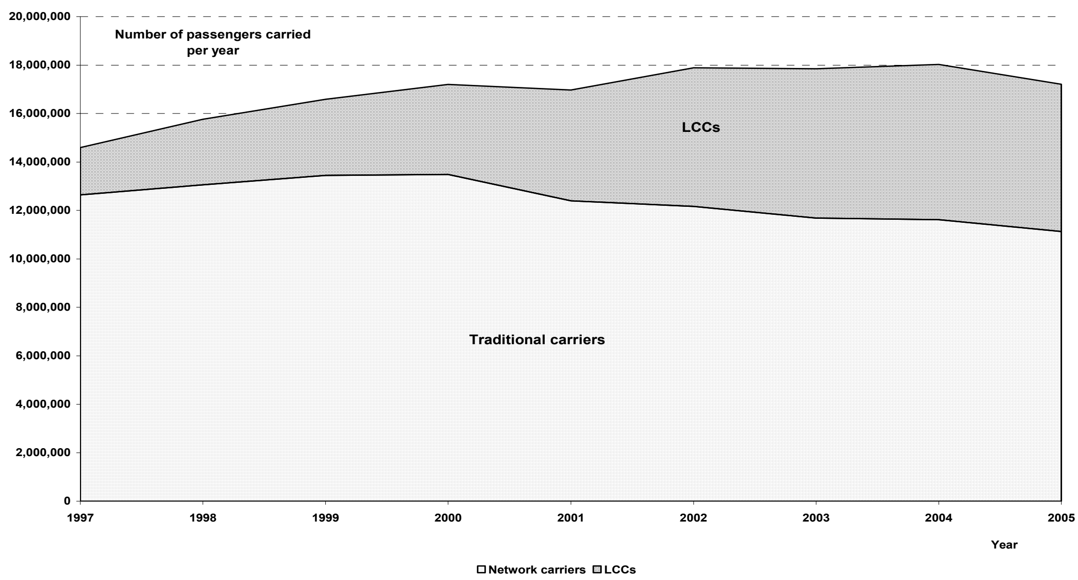
Source: UK CAA (1997-2005)

Figure 7.9: Supplied seat capacity on London-Edinburgh from 1997 to 2005



Source: UK CAA (1997-2005)

Figure 7.10: Number of passengers carried in the category 1 market from 1997 to 2005

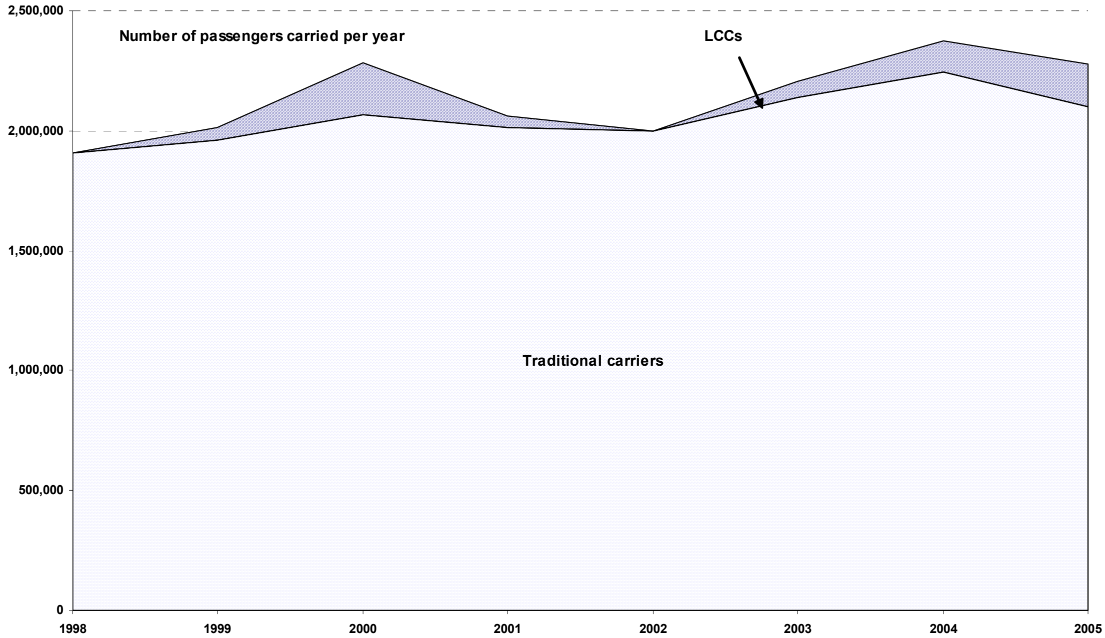


Source: UK CAA (1997-2005)

Figure 7.10 shows the total number of passengers carried in the category 1 market and the market share growth of LCCs. It also shows that the market has not increased very much after 2000 compared to the beginning of deregulation. Although competition between traditional carriers and LCCs continued to be fierce, airlines have moved their focus to other route categories in order to optimise operations resource (infra, section 3 of chapter 7).

Another UK domestic route, the London-Liverpool/Manchester route (340 kms) in the category 2 market has competition with surface transportation modes like rail and automobile. The number of carried passengers per year was about 2 million in 1998 (see Figure 7.11). Traditional carriers increased frequencies on this route to compete with LCCs and surface transportation (see Figure 7.12). In 2000, the number of airlines on this route was 5 and the annual number of carried passengers was about 2.3 million, being shared out 10% to LCCs and 90 % to British Airways and BMI British Midland. Although easyJet stopped services on this route in 2003, 9 airlines including 3 LCCs were operating in 2005. However, average load factors on this sector were lower than those of other routes in the categories 1 and 2 markets (see Table 7.5).

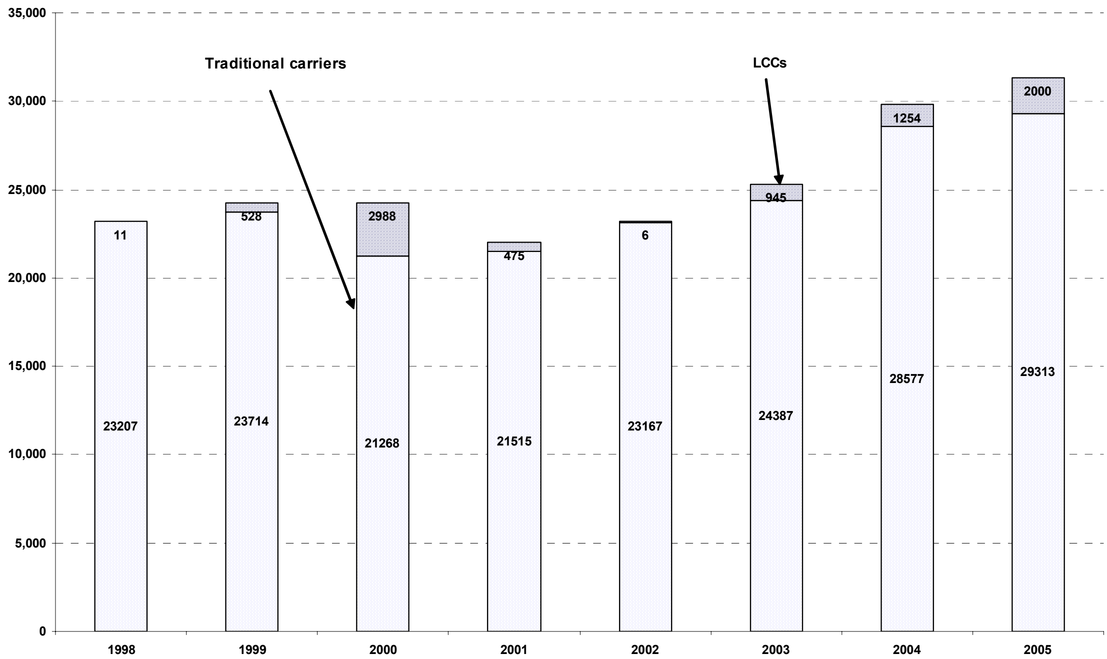
Figure 7.11: Number of passengers on the London-Manchester/ Liverpool from 1998 to 2005



Source: UK CAA (1998-2005)

Figure 7.12: Number of departures on the London-Manchester/ Liverpool from 1998 to 2005

Number of departures per year



Source: UK CAA (1998-2005)

Table 7.5: Average load factors of key players on the London-Manchester/Liverpool route

	1998	2000	2003	2005
BMI British midland	**45%**	**76%**	**67%**	**68%**
British Airways	**64%**	**68%**	**68%**	**59%**
EasyJet	**50%**	**80%**	**81%**	**80%**
KLM	**43%**	**77%**	**78%**	**78%**
Flybe		**37%**		
City			**90%**	
Ryanair			**65%**	**59%**
VLM(Belgium)			**57%**	**55%**
Air Berlin				**69%**
Jet 2				**43%**

Source: Author based on the data from UK CAA (1997-2005)

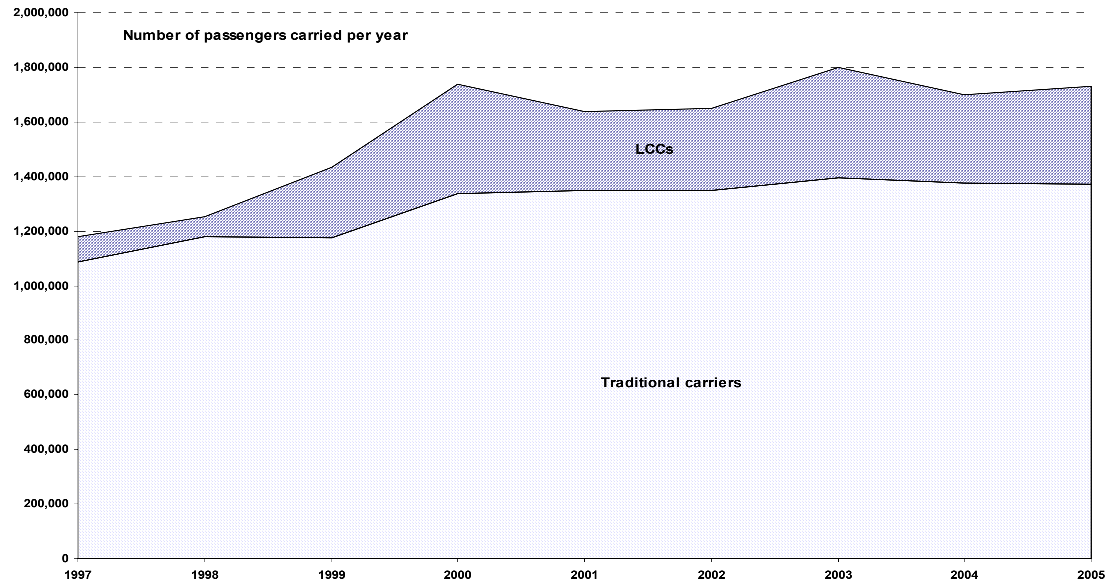
Note: Underlined airlines names refer LCCs.

On this short (340 kms) UK domestic route, the time index is about 1, which means the journey time of air transportation is almost the same as that of train and automobile. In Japan, air services on route distances of around 350-400 kms have been reduced as the result of the effects of the high speed rail (HSR) service, although the market of which the time index is 1 becomes the competition field between air transport and HSR in Japan. It demonstrates the competition market segment between air and HSR in Europe differs from that of Japan (infra, chapter 4).

On the London-Manchester/Liverpool route, demand was increased by the entry of LCCs and this stimulated competition between airlines and surface transportation. By the further improvement of railway services including speed, punctuality, fares and infrastructure on this route, competition between air and surface transport will continue in this market.

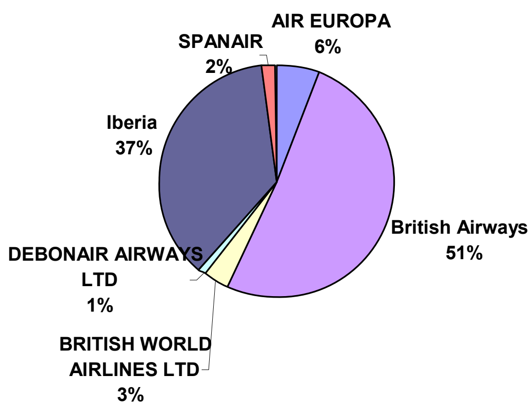
On the London-Madrid route (1,750 kms) of category 2, the number of passengers was 1.2 million in 1997 and grew up to 1.7 million in 2000, i.e. 20% growth due to the LCC effect (see Figure 7.13). In 2000, the LCC growth rate in this market was more than 35% over the previous year. The market share of traditional carriers was 92% in 1997 and dropped to 80% in 2005 compared with 20% for LCC (easyJet). However, the number of airlines decreased from 7 in 1997 to 4 in 2005, and traffic in the market actually declined between 2003 and 2005 (see Figures 7.14, 7.15 and 7.16).

Figure 7.13: Number of passengers on the London-Madrid route from1997 to 2005



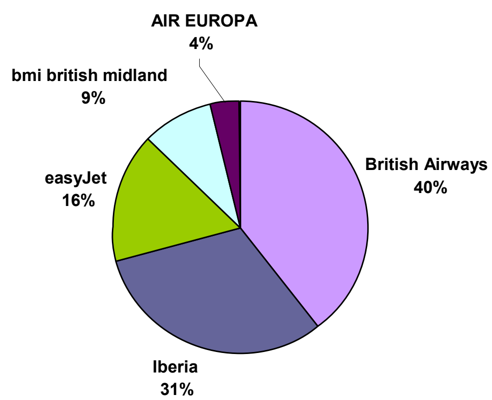
Source: UK CAA (1997-2005)

Figure 7.14: The market share (seat capacity) on the London-Madrid route in 1997



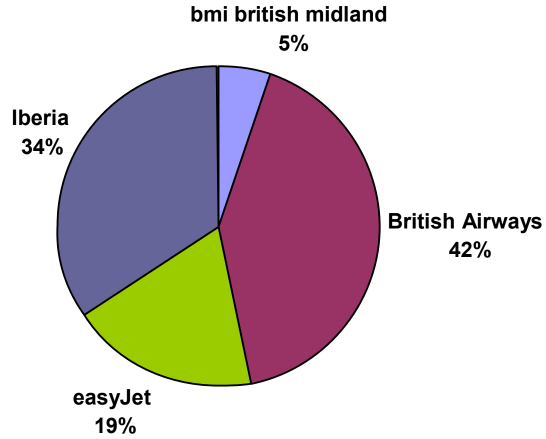
Source: UK CAA (1997)

Figure 7.15: The market share (seat capacity) on the London-Madrid route in 2003



Source: UK CAA (2003)

Figure 7.16: The market share (seat capacity) on the London- Madrid route in 2005

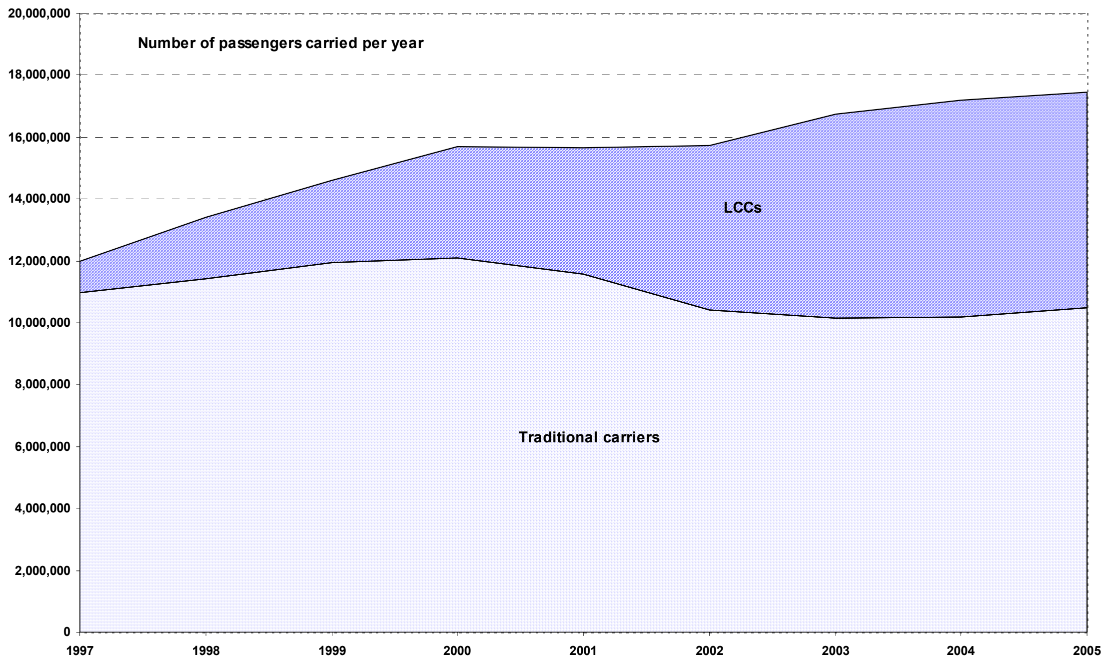


Source: UK CAA (2005)

7.3 Category 3 routes in the intra European market serving the UK and in the UK domestic market

Air transport demand in route category 3 has been stimulated and developed by LCCs and Figure 7.17 shows that the market has continued to grow steadily after 2000. In 2000, the average number of passengers carried in route category 3 was about 1.3 million. The average number of departures per day on the UK intra-European category 3 routes was 38 compared with 17 for the Tokyo category 3 market, which carried annually 2 million per sector on average using larger aircraft in 2000 (see Table 7.6). The category 3 market size of the intra-European rotues serving the UK and the UK domestic routes in 2000 was 30% greater than that of 1997 and became 17 million in 2005 compared with 11 million in 1997. Indeed, LCCs have been expanding routes aggressively and traditional carriers are also trying to maintain the shares in the market. The intensity of competition became greater after 2002 in the category 3 market in Europe. In the following, selected routes in the category 3 intra-European UK markets are analysed in detail in order to demonstrate this competitive situation.

Figure 7.17: Number of passengers carried in category 3 intra-European routes serving the UK and in the UK domestic market



Source: UK CAA (1997-2005)

Table 7.6: The characteristics of category 3 intra-European and Tokyo routes in 2000

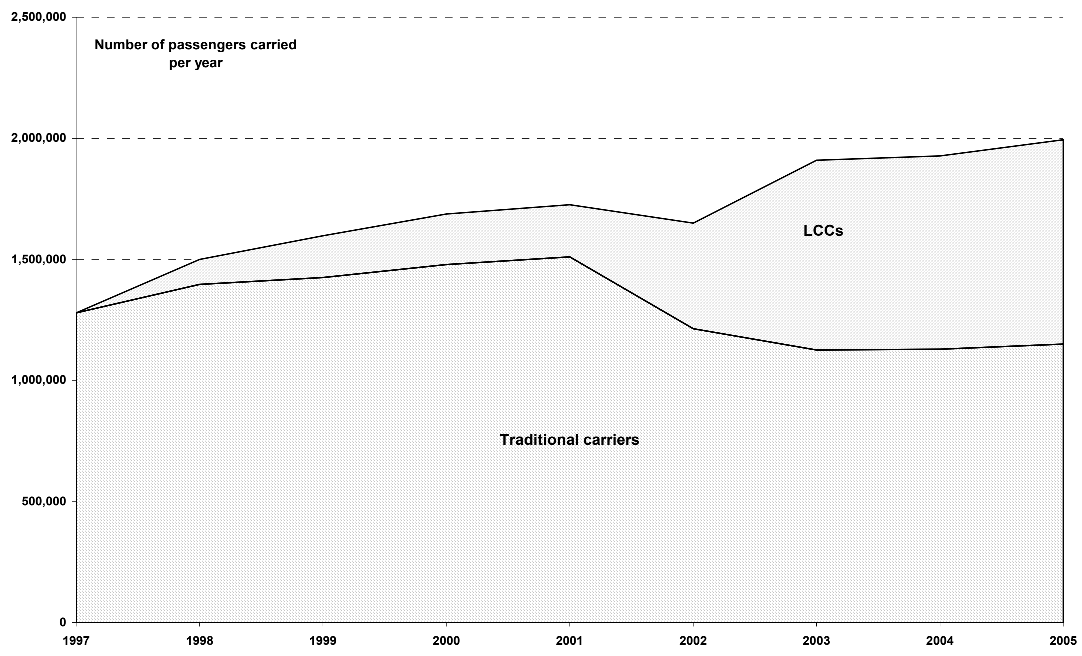
Category	Routes from A to B	Number of passengers per year	Number of departures per year/day	Average capacity per departure	Number of Traditional carriers	Number of LCC	Competition with HSR	Number of airports A	Number of airports B	Average load factor
3	LON-ROM	1,687,365	14,116	173	3	1		5	2	69%
3	LON-MIL	1,651,257	18,497	154	4	1		5	3	58%
3	LON-BRU	1,493,603	23,213	136	4	0	X	5	2	52%
3	LON-CPH	1,457,598	15,319	153	2	2		5	1	62%
3	LON-GVA	1,456,840	14,787	157	3	1		5	1	63%
3	LON-STO	1,417,820	13,085	165	2	1		5	3	66%
3	LON-MUC	1,359,873	12,271	164	2	2		5	1	68%
3	LON-BCN	1,344,631	11,152	161	3	1		5	1	75%
3	LON-NCE	1,068,000	8,772	165	2	1	X	5	1	74%
3	LON-ATH	1,022,995	7,340	194	4	1		5	1	72%
3	MAN-AMS	922,370	14,033	99	4	1		4	4	58%
3	MAN-DUB	814,322	11,359	102	3	1		4	4	70%
	Average	**1,330,263**	**14,035/38***	**152**	**3**	**1**		**5**	**1**	**64%**
3	TYO-KMJ	2,025,747	7,591	15	3	0		1	1	65%
3	TYO-HKD	2,282,289	5,308	430	2	0		1	1	61%
3	TYO-KMI	2,397,259	7,633	314	3	0		1	1	55%
3	TYO-NGS	2,482,450	7,090	350	3	0		1	1	61%
3	TYO-OKI	742,381	3,272	227	1	0		1	1	69%
3	TYO-TKM	1,696,476	5,805	292	2	0		1	1	69%
3	TYO-MYJ	2,022,223	6,374	317	2	0		1	1	64%
3	TYO-OIT	2,048,200	7,260	282	3	0		1	1	63%
	Average	**2,007,815**	**6,292/17***	**319**	**2**	**0**		**1**	**1**	**63%**

Source: Author based on the data from UK CAA (2000) and Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Note: * The number of departures per day

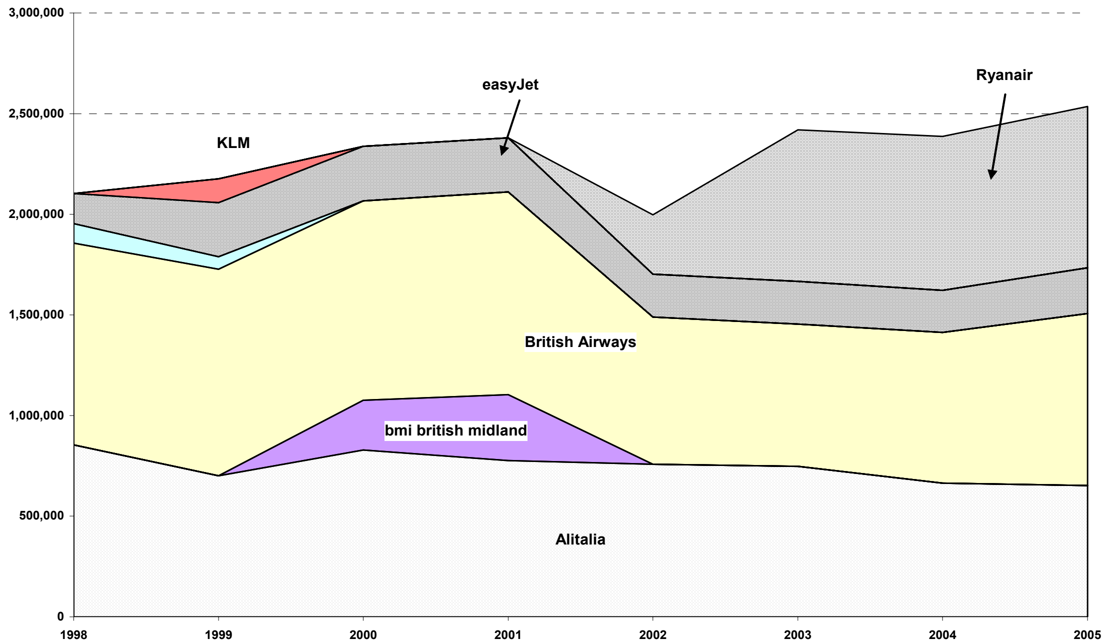
On the London-Rome route, the market was stimulated by competition between Traditional carriers and LCCs. In 1997 when easyJet entered this route, the number of passengers carried by the 5 Traditional carriers was 1.3 million per year. After Ryanair's entry in 2001, competition was accelerated and the number of passengers carried by LCCs was increased by 102% over the previous year compared with a 20% decline for traditional carriers. Although demand dropped temporarily in 2002 because BMI British Midland stopped services on this route, two LCCs further stimulated demand on this market pair and the number of passengers carried by LCCs was 0.84 million in 2005, representing 42% of the market. While traditional carriers (British Airways and Alitalia) saw their share decrease until 2003, they attempted to compete with LCCs and stop their expansion on this route, resulting in a stabilisation of market shares (see Figures 7.18 and 7.19). This route is characterised as experiencing severe competition between traditional carriers and LCCs.

Figure 7.18: Number of passengers on the London-Rome route from 1997 to 2005



Source: UK CAA (1997-2005)

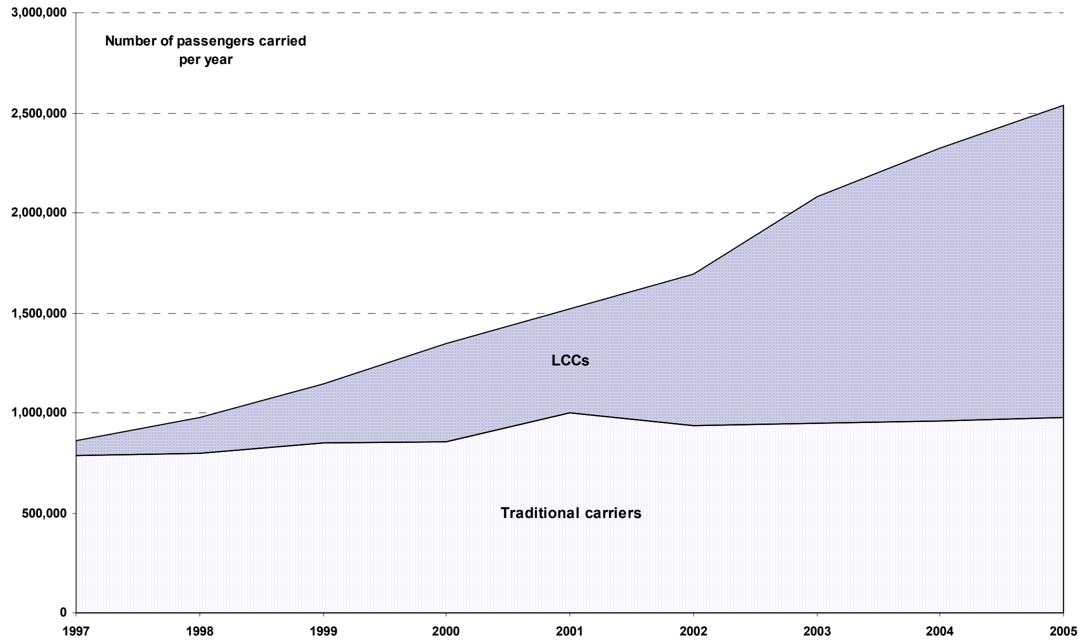
Figure 7.19: Supplied seat capacity on the London-Rome route from 1998 to 2005



Source: UK CAA (1998-2005)

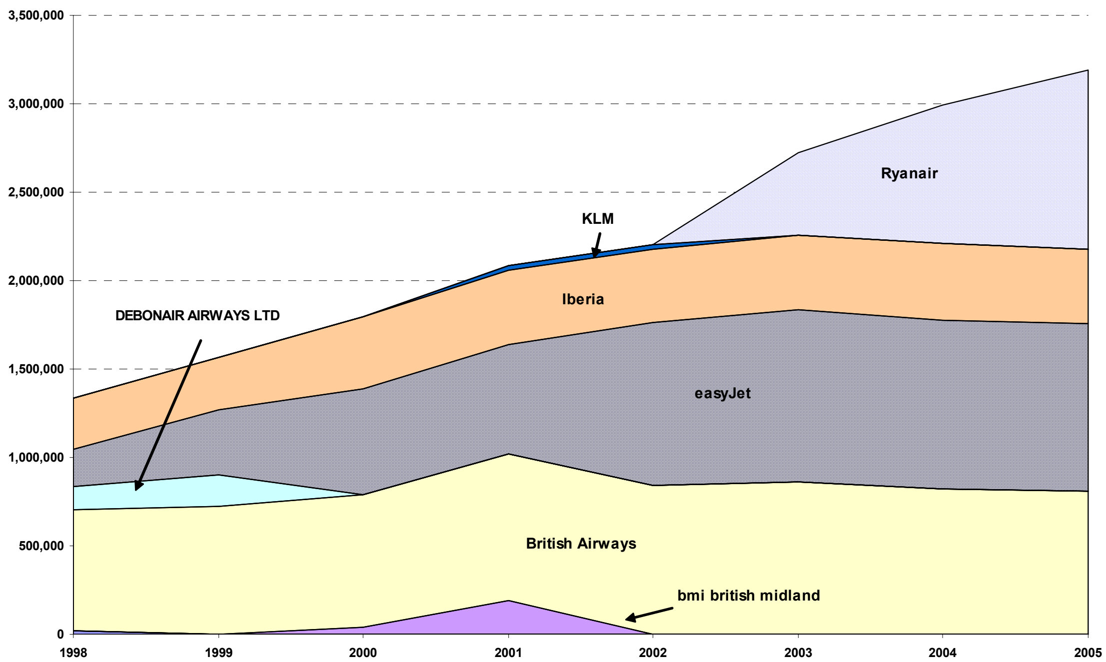
Figure 7.20 demonstrates the significant impact of LCCs on the London-Barcelona route. In 1997 the number of passengers on this route was only 0.8 million carried by 6 airlines including one LCC, easyJet. EasyJet had been developing demand at a 13%-18% growth rate every year and shared 45% of the market, which was 1.7 million in 2002. The number of passengers carried by LCCs (easyJet and Ryanair) increased by 45% over the previous year after the entry of Ryanair in 2003 and total demand rose to 2.5 million passengers, which was carried by 2 traditional carriers (British Airways and Iberia and 2 LCCs (easyJet and Ryanair) (see Figure 7.21). In 2005 the LCCs' growth dropped by 7% over the previous year compared with a 1% increase for traditional carriers. The London-Barcelona market was expanded by 16% per annum from 1997 to 2003. However, the significant growth which was observed in 5 years from 1997 seemed to abate from 2004, similar to the London-Rome routes. Four airlines, including 2 LCCs, survived on this route and all of them are trying to maintain the market share on this fiercely competitive market pair.

Figure 7.20: Number of passengers on the London-Barcelona route from 1997 to 2005



Source: UK CAA (1997-2005)

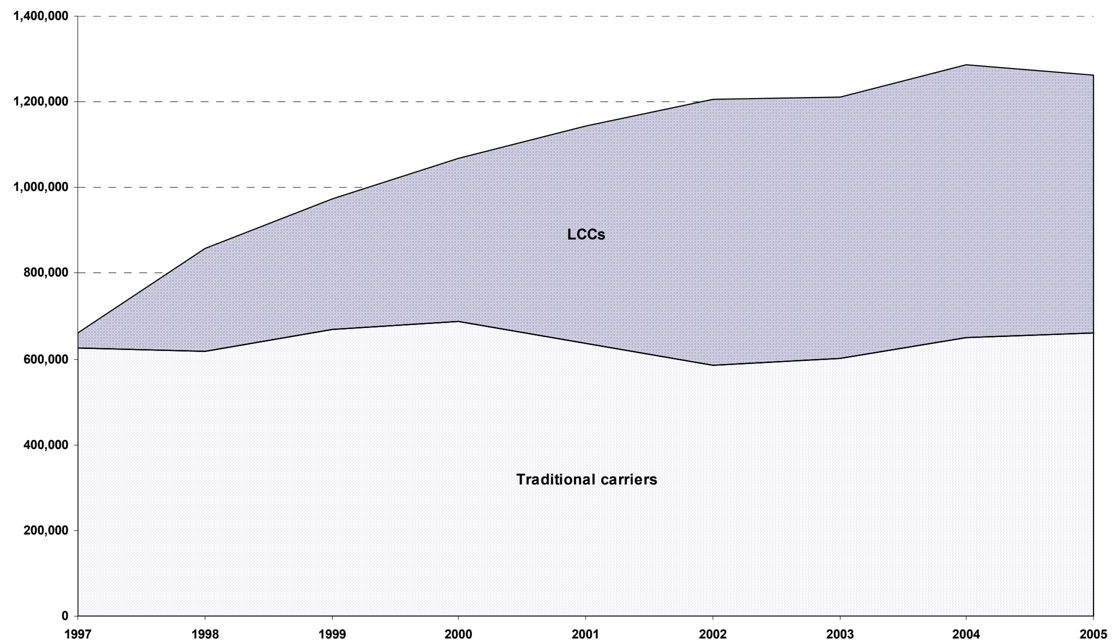
Figure 7.21: Supplied seat capacity on the London-Barcelona route from 1998 to 2005



Source: UK CAA (1998-2005)

Another popular holiday route, the London-Nice market was also stimulated by LCCs. The number of passengers was increased from 0.66 million in 1997 to 1.3 million in 2005 due to easyJet's active expansion on this route (see Figure 7.22). It was increased by 30% per annum at high load factors until 2002. After the market was shared out 50/50 to both traditional carriers and easyJet in 2003, the number of passengers carried by traditional carriers in 2005 was about 4% higher compared to 1997 (see Table 7.7 and Figure 7.23).

Figure 7.22: Number of passengers on the London-Nice route from 1997 to 2005



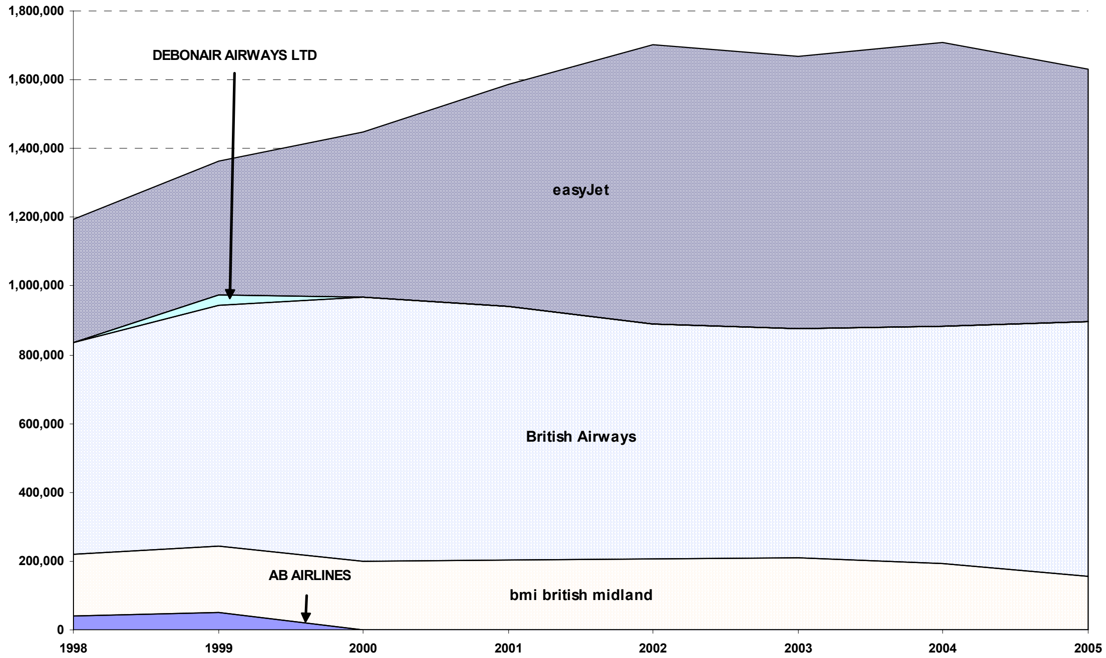
Source: UK CAA (1997-2005)

Table 7.7: Average load factors on the London-Nice route

Airline	1997	1998	2000	2003	2005
AB Airline		53%			
BMI British midland	75%	62%	63%	60%	71%
British Airways	73%	74%	73%	71%	74%
EasyJet	70%	69%	79%	77%	82%
Average	73%	72%	72%	70%	76%

Source: Author based on data from UK CAA (1997-2005)

Figure 7.23: Supplied seat capacity on the London-Nice from 1998 to 2005



Source: UK CAA (1998-2005)

7.4 Categories 4 and 5 routes in the intra-European market serving UK and the UK domestic market

The routes of which the number of carried passengers is less than 1 million are categorised as categories 4 and 5 in this study. Most intra-European routes serving the UK and many UK domestic market pairs fall in to one of these categories. For example, 97% of the 656 intra-European routes serving UK and the UK domestic market belong to these categories 4 and 5, excluding 22 routes of categories 1, 2 and 3. In this analysis, the routes with less than 1 million, but more than 0.7 million passengers per year, are categorised as category 4. Other small markets are categorised as category 5 according to the category scale of the Tokyo market analysis. Like the categories 4 and 5 markets on the Tokyo routes, the markets of the routes in categories 4 and 5 were so dynamic that the market scale was changed dramatically in a year, e.g. the London-Malaga route. This phenomenon is more prevalent on the intra-European routes serving UK and the UK domestic market than in Japan. This dynamic power is a characteristic of the intra-European routes serving the UK and the UK domestic routes and has a substantial impact on the market. In order to demonstrate these characteristics, several routes are chosen from categories 4 and 5 routes and analysed as follows (see Tables 7.8 and 7.9).

Table 7.8: Examples of category 4 intra-European and Tokyo routes in 2000

Category	Routes From A to B	Number of passengers per year	Number of departures per year/day	Average capacity per departure	Number of Traditional carriers	Number of LCC	Competition with HSR	Number of airports at A	Number of airports at B	Average load factor
4	LON-OSL	949,168	10,595	149	3	1		5	1	60%
4	LON-ABZ	936,020	8,661	157	1	2		5	1	69%
4	LON-LIS	854,767	7,002	169	2	1		5	1	72%
4	LON-AGP	847,496	6,550	162	3	2		5	1	80%
4	LON-DUS	875,695	14,548	131	4	0		5	1	55%
4	LON-VIE	781,092	7,363	166	4	0		5	1	64%
4	LON-HAM	753,995	10,620	125	3	2		5	2	57%
4	LON-ORK	752,358	6,806	142	2	2		5	1	78%
4	LON-NCL	725,146	8,855	122	3	1	X	5	1	67%
	Average	**830,637**	**9,000/25***	**147**	**3**	**1**		**5**	**1**	**67%**
4	TYO-AXT	882,392	4,727	309	2	0	X	1	1	61%
4	TYO-TOY	872,164	4,205	298	1	0		1	1	70%
4	TYO-UBE	670,223	3,627	275	1	0	X	1	1	67%
4	TYO-TKS	807,927	5,093	262	2	0		1	1	61%
4	TYO-KCZ	861,112	5,637	247	3	0		1	1	62%
4	TYO-ASJ	735,004	4,783	269	2	0		1	1	57%
4	TYO-AOJ	978,419	5,783	260	2	0	X	1	1	65%
4	TYO-KUH	530,870	3,758	246	2	0		1	1	58%
	Average	**792,264**	**4,703/13***	**270**	**1.8**	**0**		**1**	**1**	**62%**

Source: Author based on data from the UK CAA (2000) and Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Note:* Number of departures per day

Table 7.9: Examples of category 5 intra-European and Tokyo routes in 2000

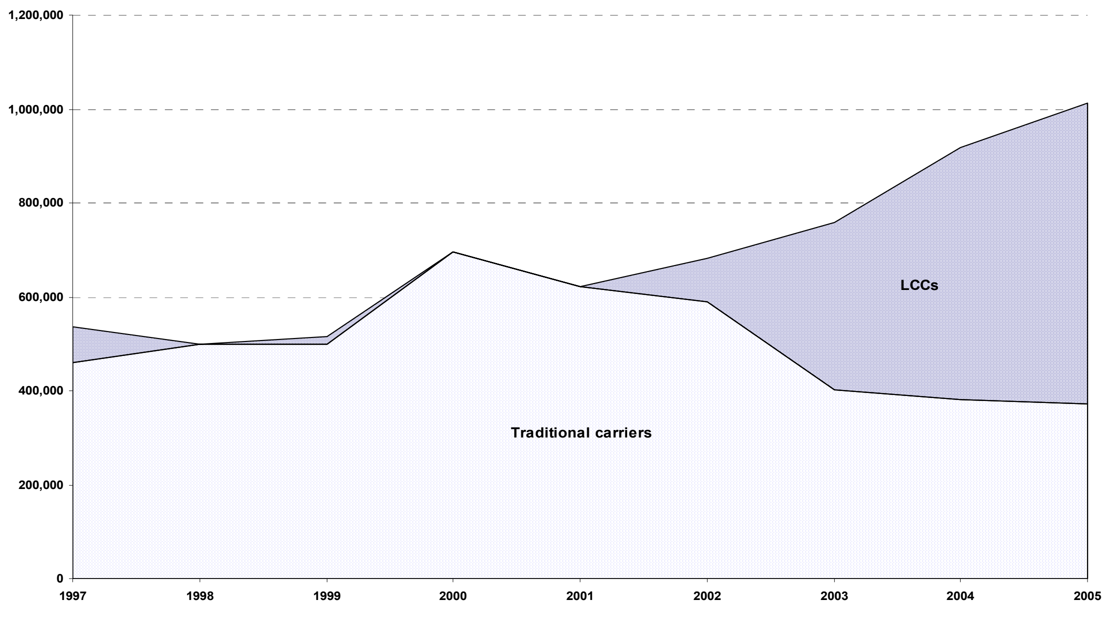
Category	Routes From A to B	Number of passengers per year	Number of departures per year/day	Average capacity per departure	Number of Traditional carriers	Number of LCC	Competition with HSR	Number of airports at A	Number of airports at B	Average load factor
5	LON-BER	696,257	6,826	165	3	1		5	3	62%
5	LON-VCE	638,094	6,594	154	1	2		5	1	63%
5	LON-STR	376,419	5,023	161	3	0		5	1	53%
5	LON-PSA	380,432	3,125	163	2	1		5	2	74%
5	LON-MME	157,962	2,174	117	2	1		5	1	62%
	Average	**449,833**	**4,748/13***	**152**	**2**	**1**		**5**	**2**	**63%**
5	TYO-YGJ	364,843	2,867	127	1	0	X	1	1	61%
5	TYO-IZO	498,303	3,078	162	1	0		1	1	68%
5	TYO-MMB	498,760	3,078	162	3	0	X	3	1	57%
5	TYO-OBO	523,311	2,895	181	2	0		3	1	62%
5	TYO-SYO	366,093	2,163	169	1	0		1	1	69%
5	TYO-TTJ	331,490	2,188	152	1	0		1	1	64%
5	TYO-KKJ	158,818	1,946	82	1	0	X	1	1	61%
5	TYO-MSJ	430,397	2,836	152	1	0		1	1	58%
5	TYO-SHM	142,962	1,856	77	1	0		1	1	56%
5	TYO-ONJ	106,702	1,248	85	1	0		1	1	57%
5	TYO-HSG	166,030	1,458	114	1	0		1	1	59%
5	TYO-WKJ	155,327	1,014	153	1	0		1	1	59%
5	TYO-SHB	109,672	1,437	76	1	0		1	1	50%
5	TYO-GAJ	72,258	728	99	1	0		1	1	58%
5	TYO-IWJ	102,083	1,447	71	1	0		1	1	43%
	Average	**268,470**	**2,016/6***	**124**	**1**	**0**		**1**	**1**	**59%**

Source: Author baed on data from UK CAA (2000) and Ministry of Land, Infrastructure and Transport, Aviation statistics (2000)

Note: * Number of departures per day

Several routes in the category 5 market have grown extensively due to competition between traditional carriers and LCCs even after 2003. This is particularly the case on the routes serving the destinations which have multiple alternative airports. Figures 7.24 and 7.25 show the dynamic competitive developments on the London-Berlin route of category 5. In 1997, the annual number of carried passengers was 0.5 million on this route, of which 86% were flown by the traditional carriers. Traffic dropped by 7% in 1998 as a result of a LCC exiting this route. However, the following year demand increased by 35% over the previous year when Eurowings entered this market. In 2000, while this market became occupied only by the traditional carriers again, the number of passengers carried reached 0.69 million. In the following year, demand increased due to the new entrant, Air Berlin. The LCCs' market share grew to 47% when Ryanair entered in 2003 and increased to 63% with the entry of easyJet in 2004. The number of passengers carried increased to 1 million in 2005, although the growth rate of the traditional carriers over the previous year had been negative since 2003. Two strong LCCs (Ryanair and easyJet) and the Berlin-based new entrant, Air Berlin expanded the market on the London-Berlin route of category 5, while the Traditional carriers set up the traditional carriers' LCC subsidiaries (Germanwing and Go fly) in order to compete with strong LCCs.

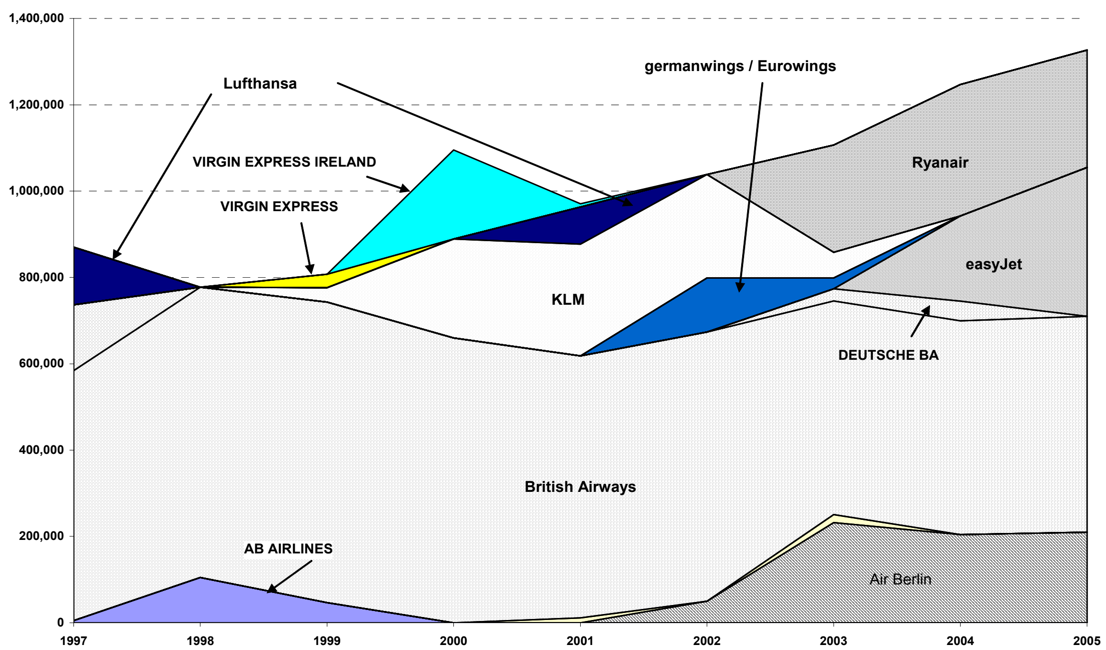
Figure 7.24: Number of passengers on the London-Berlin route from 1997 to 2005



Source: UK CAA (1997-2005)

Table 7.10 shows the change of average load factors on this route, which were very low in 1997 compared to those of 2005, and demonstrates that airlines with high load factors ultimately survived.

Figure 7.25: The market share on the London-Berlin route from 1997 to 2005



Source: UK CAA (1997-2005)

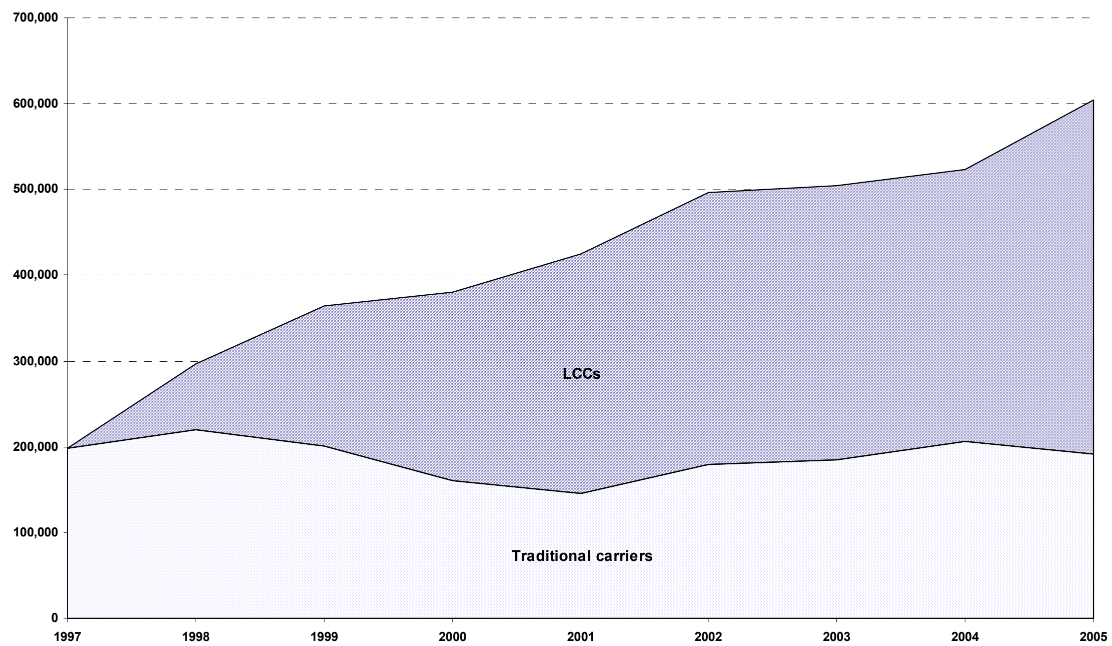
Table 7.10: Average load factors on London-Berlin route

Airline	1997	2000	2003	2004	2005
AB Airlines	33%				
Air Berlin			62%	62%	67%
Augsburg Airways GMBH			74%		
British Airways	61%	65%	73%	77%	74%
Deutsche BA	49%		31%	24%	
easyJet				81%	79%
Eurowings			44%		
KLM		60%	48%		
Lufthansa	62%				
Ryanair			77%	79%	84%
Virgin Express Ireland		55%			
Average	51%	60%	58%	65%	76%

Source: Author based on data from UK CAA (1997-2005)

The London- Pisa /Florence route is another example of a category 5 market. Pisa and Florence are located in Tuscany, Italy, an attractive popular holiday destination with a population of 2.2 million in the 1 hour drive time catchment area from Pisa airport and a relatively strong economic background. Local regional GDP per capita was USD 27,615 in 2003, which was larger than that of Osaka (USD 25,714) and Berlin (USD 25,270). The market was stimulated by an LCC (Ryanair) and traffic tripled in 8 years as a result. The number of passengers carried was only 0.2 million in 1997 and grew by 30% over the previous year in 2000 and increased to 0.6 million in 2005 (see Figure 7.26).

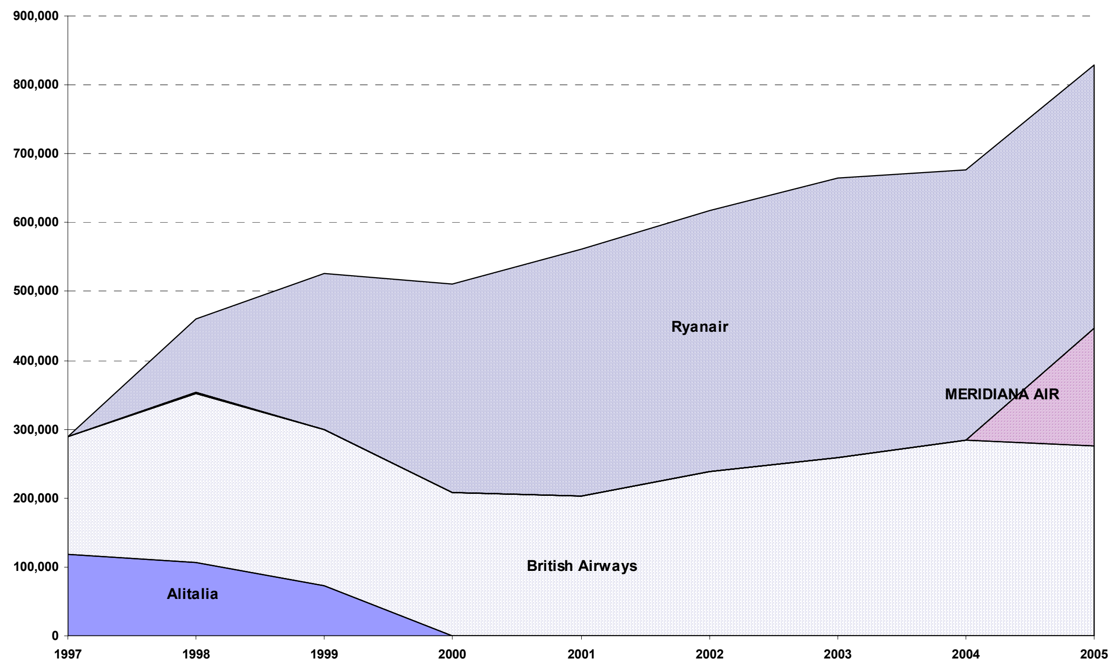
Figure 7.26: Number of passengers on the London-Pisa/ Florence route from 1997 to 2005



Source: UK CAA (1997-2005)

Figure 7.27 demonstrates the market growth of Ryanair and the decline in this market of Alitalia, the Italian flag carrier. The average load factor of Alitalia was only 51% compared with 73% of British Airways and 77% of Ryanair during 1997 to 2005. Ryanair built its market presence in Pisa by establishing an operatingbase at Pisa airport in 2005.

Figure 7.27: Supplied seat capacity on the London-Pisa/Florence route from 1997 to 2005



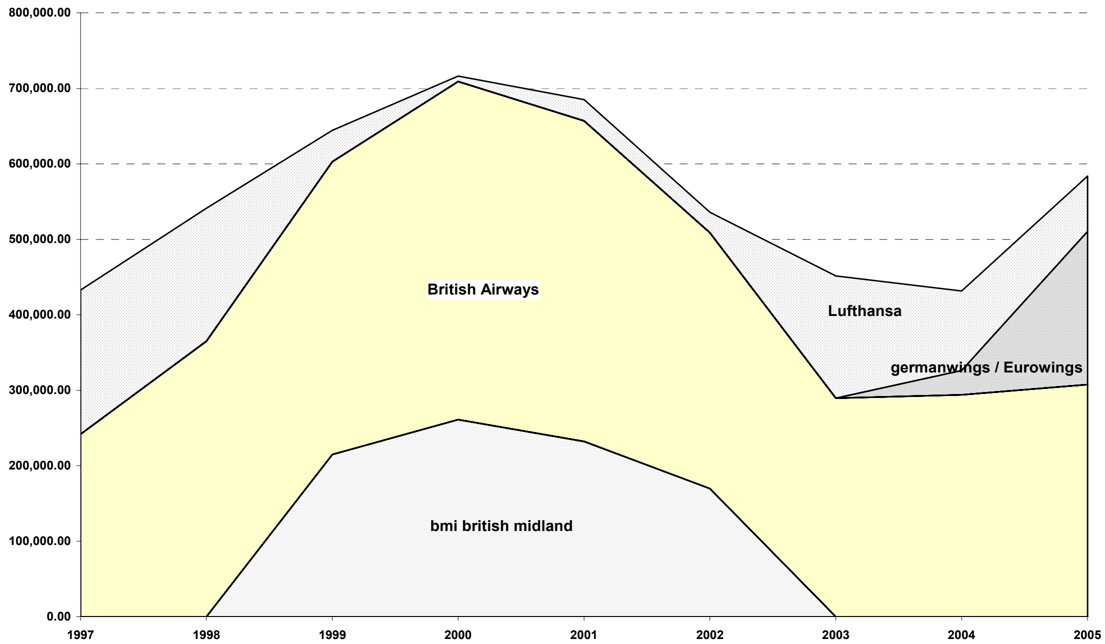
Source: UK CAA (1997-2005)

By contrast, on the London-Stuttgart route, a business route between Germany and the UK in category 5, the market had been dominated by the traditional carriers, such as British Airways and Lufthansa (see Figure 7.28). Although the number of passengers had been increasing from 1997 to 2000 as a result of economic growth and of deregulation, demand decreased from 2000 until 2003. BMI British Midland stopped air services on this route following its strategy change which involved switching routes to sun destinations in 2003. On the other hand Lufthansa established its LCC subsidiary, Germanwings in 2002 and expanded its share by utilising its Stuttgart-based LCC from 2003 to compete with British Airways on this market pair (see Figure 7.29). The market share on the relatively small size business route is subsidised by the traditional carrier's LCC to compete with other traditional carriers. Interestingly, this characteristic is very similar to that of Japanese market and Japanese traditional carriers' reactions such as on the Tokyo-Asahikawa and Miyazaki routes. However, the demographic and economic backgrounds are totally different between the London-Stuttgart route and the Tokyo-Asahikawa and Miyazaki routes. The population in the Stuttgart area (1 hour drivetime catchment) was more than 5.2 million in 2000 compared with 1.6 million in Miyazaki and the local regional GDP per capita of the Stuttgart case was USD 35,097 contrasted with USD 19,839 in the Japanese case.

Figure 7.28: Number of passengers on the London-Stuttgart route from 1997 to 2005

Source: UK CAA (1997-2005)

Figure 7.29: Supplied seat capacity on the London-Stuttgart route from 1997 to 2005



Source: UK CAA (1997-2005)

7.5 Summary

The growth of the intra-European air transport market serving the UK and the substantial impact of LCCs has been demonstrated in this chapter. These results are summarised and compared with the Tokyo routes in Tables 7.11 and 7.12. The analysis shows that given the significant size of the Tokyo market the routes are operated by large aircraft at lower frequency compared to the intra-European market serving the UK. The average number of airlines operating on the intra-European routes serving the UK varies between 4 and 6 compared with 1 to 4 in Japan. In particular, the impact of LCCs on the market is prominent in Europe while in Japan it has been very limited (c.f. supra, chapter 6). Moreover, the number of airports at the destinations is totally different between the intra-European and Tokyo markets. It is clear that the airport system consisting of 5 airports in London area has provided significant opportunities to stimulate demand in the intra-European market. In Europe, the category 1 market was developed extensively until 2000 by the effects of competition between traditional carriers and LCCs as a result of deregulation. While both types of airline had continued competing in the busy category 1 market, the focus of competition shifted to the category 2 market from 2000. Moreover, competition was extended to the categories 3, 4 and 5 markets in order to optimise the operational resources and expand any possibilities to survive in the market. This has been demonstrated clearly since 2002.

In particular, as a result of competition the reactions of airlines to reduce or increase supply on the route in attempting to keep very high load factors is very sensitive compared to that of Japan. The intra-European routes serving the UK are very responsive to changes in demand because airlines, especially LCCs, have chosen destinations which have enough potential to develop the market. Among the categories 4 and 5 markets, on the London-Oslo (population: 1.5 million, GDP per capita: USD 67,254), the London-Pisa/Florence and the London-Stuttgart routes, demand was stimulated significantly by competition among airlines. This is demonstrated by the year-on-year percentage changes in Tables 7.11 and 7.12. All of the categories in the intra-European market serving UK increased from 2000, whereas there was negative growth in 2003 on the Tokyo routes except category 1 routes.

Table 7.11: Average demand and supply change by market category in the intra-European routes serving UK and Tokyo routes in 2000

Category	Number of passengers per year	Number of departures per year/day	Average capacity per departure	Number of routes	Number of Traditional Airlines	Number of LCC	Competition with HSR(number of routes)	Number of airports A	Number of airports B	% change over the previous year				% change over 1997				
										Frequency	Demand	Supply	Load factor	Frequency	Demand	Supply	Load factor	Average load factor
Intra-European routes serving UK																		
1	3,440,947	34,760/95	142	5	4	1.6	1	5	1	1%	4%	1%	3%	1%	18%	16%	2%	70%
2	2,018,495	20,281/56	155	5	2.6	1.4	1	5	2	5%	11%	8%	3%	5%	31%	37%	-4%	65%
3	1,330,263	14,035/38	152	12	4	2	2	4	2	3%	7%	4%	4%	3%	31%	28%	2%	64%
4	821,241	8,555/23	147	9	3	1	2	5	1	5%	6%	3%	0%	5%	36%	39%	2%	66%
TYO routes																		
1	6,269,214	7,591/21	315	4	3	0.5	2	1	1	9.5%	6.8%	8%	-1%	33%	22%	26%	-2%	65%
2	2,151,198	5,308/15	430	4	3	0	2	1	1	17%	8%	14%	-5%	29%	21%	22%	0%	61%
3	1,256,580	7,633/21	314	8	2	0	0	1	1	7%	4%	4%	0%	9%	8%	7%	0%	55%
4	792,259	7,090/19	350	8	2	0	3	1	1	6.7%	6.6%	3%	6%	12%	6%	10%	-4%	61%
5	268,603	3,272/9	227	15	1	0		1	1	5.6%	-0.2%	4%	-6%	-8%	-4%	-3%	-6%	69%

Source: UK CAA (1997-2000) and Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2000), Note: The intra-European routes serving UK includes the UK domestic market.

Table 7.12: Average demand and supply change by market category in the inter European and Tokyo routes in 2003

Category	Number of passengers per year/day	Number of departures per year/day	Average capacity per departure	Number of Traditional	Number of LCC	Competition with HSR	Number of airports A	Number of airports B	% change over the previous year				% change over 1997				Average load factor
									Frequency	Demand	Supply	Load factor	Frequency	Demand	Supply	Load factor	
Inter EU routes																	
1	3,568,846	34,422/94	141	3	1.4		5	1	-3%	0%	-2%	2%	10%	22%	15%	6%	73%
2	1,988,607	19,625/54	144	2.6	1.6		5	2	-2%	2%	-4%	6%	29%	29%	24%	4%	71%
3	1,429,982	13,676/37	148				5	2	2%	6%	6%	1%	24%	40%	25%	12%	70%
4	917,732	8,375/23	150				5	1	2%	5%	4%	1%	25%	51%	29%	19%	73%
TYO routes																	
1	7,051,704	25,271/	432	3.5	0.5	X	1	1	1.2%	0.7%	1.2%	-4%	54%	37%	47%	-6%	65%
2	2078,872	10,675	306	3	0	X	1	1	-1.3%	-3.2%	-7.7%	-4%	51%	21%	30%	-6%	65%
3	1,358,999	8,051	268	2	0		1	1	-3%	-3%	-7.5%	-1%	42%	21%	24%	-5%	64%
4	843,144	5,100	258	2	0		1	1	-4%	-1.5%	-7%	-6%	27%	15%	24%	-7%	64%
5	243,702	2,023	190	1	0		1	1	1%	1%	-1.7%	-1%	-21%	-15%	-15%	-2%	64%

Source: UK CAA (1997-2004) and Ministry of Land, Infrastructure and Transport, Aviation statistics (1997-2004)

Note: The intra-European routes serving UK includes the UK domestic market.

The demographic and economic background of the market is relatively smaller on the Tokyo routes compared with the intra-European routes serving the UK. Table 7.13 shows the population and local regional GDP per capita of the destinations studied in the previous analysis. According to this data in each airport's catchment area, the catchment size of Edinburgh (category 1) is almost the same as Hiroshima (category 2) and Dublin (category 1) is similar to Komatsu (category 2). Both the Tokyo-Hiroshima and Komatsu routes have expanded the markets because of the large catchment size and strong economic activities. In addition, Berlin (category 5) has a similar catchment size and GDP per capita as Fukuoka (category 1). It evidenced potential demand on the London-Berlin route.

More than half of category 5 routes in the Tokyo market are the same size as the London-Durham market. The number of passengers carried per year is around 0.1 to 0.15 million. The population in the catchment area was less than 1 million compared to 2.2 million in Durham in 2003 although GDP per capita was similar at USD 21,000 per year. For example, Skymark airlines entered the Tokyo-Aomori [28] and Tokyo-Tokushima [29] route, where the market sizes were smaller than that of the London-Durham (see Table 7.13). In addition, the Tokyo-Aomori routes have competition between air transport and HSR since 2002. Therefore, Skymark and other airlines added too much capacity to this type of markets (c.f. chapter 9, section 9.4).

Three outstanding results of liberalisation in the Tokyo route market were found as a result of the study in chapter 6: (1) decreased demand, (2) increased fares and (3) new entrant failures. Two of those results, decreased demand and the insignificant impact of new entrants in the Tokyo route market, were demonstrated in the comparative analysis of this chapter 7. The results also show that the difference in the number of airports serving routes is also significant. Moreover, airlines in Europe are very responsive in order to optimise operational resources by adjusting supply and frequency as a result of competition. Furthermore, it was highlighted that on most of the Tokyo routes, air services are carrying larger number of passengers, even though the demographic and

[28] The population in Aomori was 1.5 million and GDP per capita was USD18, 259 in 2003.
[29] The population in Tokushima was 0.8 and GDP per capita was USD24, 049 in 2003.

economic activities are lower than those of the intra-European market serving the UK. Indeed, there is a huge gap between the level of the market size and the demographic /economic activities surrounding the airport region in Japan compared with the intra-European market. Moreover, some of the Tokyo routes have experienced competition with HSR.
By investigating the aforementioned differences, it can be seen that the three results of liberalisation in the Tokyo route market are caused by several constraining factors for competition in Japan.

To demonstrate and confirm the unique situation in Japan after liberalisation, an analysis based on Structural Equation Modelling is conducted in chapter 8 using the factors which have been studied in chapters 4 and 6. In the following chapter 9, these constraints on competition and their inter relationship are specified and analysed.

Table 7.13: Population and local regional GDP per capita of the destinations by category

Category	City	Airport	Population (60 min drive catchment area)	Local regional GDP Capita (USD, 2003)	Category	Airport/ Prefecture	Population	Local regional GDP Capita (USD, 2003)
1	London	LHR	12,066,568	44,038	1	Tokyo	12,310,000	36,069
1		LTN	9,547,987	44,038	1	Osaka	8,820,000	25,714
1		LGW	9,270,310	44,038	1	Fukuoka	5,050,000	22,223
1		STN	5,884,688	44,038	1	Sapporo	5,660,000	21,513
1	Paris	CDG	11,671,408	43,477	1	Okinawa	1,350,000	17,261
1		ORY	11,671,408	43,477				
1	Amsterdam	AMS	7,698,652	37,750				
1	Edinburgh	EDI	2,757,934	28,317				
1	Glasgow	GLA	2,582,350	26,905				
1	Dublin	DUB	2,128,370	42,229				
2	Frankfurt	FRA	6,375,426	34,441	2	Hiroshima	2,880,000	24,083
2	Manchester & Liverpool	MAN/LPL	7,691,377/5,649,887	27,401/21,454	2	Kagoshima	1,770,000	18,926
2	Madrid	MAD	4,865,976	26,772	2	Komatsu	1,180,000	24,117
2	Zurich & Basel	BSL	4,217,248	40,477				
2	Belfast	BFS	1,692,500	23,339				
3	Milan	LIN	7,559,893	32,153	3	Kumamoto	1,850,000	20,473
3		BGY	7,116,088	32,153	3	Nagasaki	1,500,000	18,487
3		MXP	6,002,178	32,153	3	Matsuyama	1,480,000	19,645
3	Barcelona	BCN	4,575,632	24,410	3	Oita	1,220,000	22,375
3	Rome	CIA	3,596,698	29,087	3	Miyazaki	1,160,000	19,839
3		FCO	3,596,698	29,087	3	Takamatsu	1,020,000	22,392
3	Munich	MUC	3,384,553	41,589				
3	Copenhagen	CPH	2,600,000	38,315				
3	Stockholm	ARN	2,400,000	44,654				
3		NYO	2,400,000	44,654				
3		VST	2,400,000	44,654				
3	Geneva	GVA	1,805,010	40,477				
4	Hamburg & Lubeck	HAM/LBC	3,804,404/2,571604	29,804/25,884	4	Yamaguchi	1,510,000	23,846
4	Athens	ATH	3,761,810	16,417	4	Aomori	1,460,000	18,259
4	Lisbon	LIS	3,500,000	20,527	4	Akita	1,170,000	19,806
4	Vienna	VIE/BTS	2,745,149/2,753,000	43,048/13,301	4	Toyama	1,120,000	25,562
4	Pisa & Florence	PSA	2,271,306	27,615	4	Tokushima	820,000	24,049
4	Newcastle	NCL	2,058,840	24,865	4	Kochi	810,000	18,918
4	Nice	NCE	1,539,362	26,219	4	Kushiro		21,513
4	Oslo	OSL/TRF	1,500,000/600,000	67,254/30,971				
4	Malaga	AGP	986,193	15,393	5	Nanki shirahama	1,060,000	
4	Cork	ORK	400,000	42,229	5	Izumo	750,000	
4	Aberdeen	ABZ	331,846	37,800	5	Iwami	750,000	
5	Stuttgart	STR	5,226,640	35,097	5	Yonago	610,000	
5	Berlin	SXF	4,683,110	25,270	5	Tottori	610,000	
5		TXL	4,477,950	25,270				
5		THF	4,470,595	25,270				
5	Venice	VCE	2,938,129	28,437				
5	Durham Tees Valley	MME	2,248,975	21,123				

Source: Author based on data from Eurostat (2003) and Ministry of Internal affairs (2000 and 2003)

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Chapter 8: Structural equation modelling analysis of the Tokyo routes market

In this eighth chapter, Structural Equation Modelling is conducted in order to demonstrate and confirm the results of the analyses in chapters 4 and 6. This chapter aims to investigate the relationship between factors, which are discovered as key determinants of the structure of the Tokyo domestic air transport market in Japan.

Structural Equation Modelling and its mechanism is explained using the relevant literature[30] in sections 8.1, 8.2 and 8.3.

8.1 Structural Equation Modelling

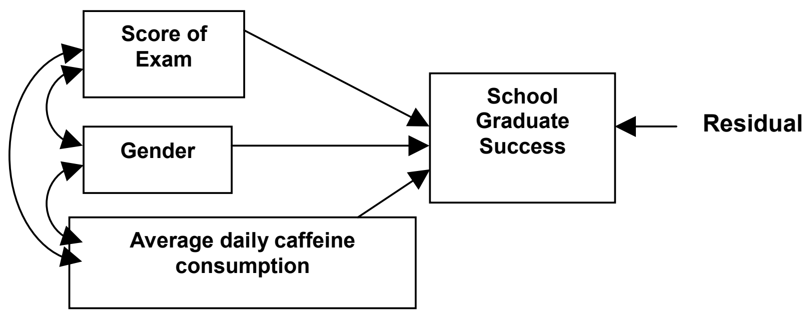
Structural equation modelling (SEM) is a relatively new and sophisticated technique that allows the testing of various models to ascertain the interrelationships among a set of variables. Based on multiple regression and factor analytic techniques, it allows the importance of each independent variable in the model to be evaluated and the overall fit of the model to the data to be tested, as well as comparison of alternative models (Pallant, 2002). In other words, SEM uses various types of models to represent relationships among observed variables, with the same basic objective of providing a quantitative test of a theoretical model hypothesized by a researcher. Various theoretical models can be tested in SEM that hypothesise how sets of variables define constructs and how these constructs are related to each other (Schumacher and Lomax, 2004).

Factors have been used both as independent variables and dependent variables in the literature modelling the effects of air transport liberalisation (c.f. supra, chapter 1 and appendices A and B). In Structural Equation Modelling, it is quite unique that all the observed variables, which are used in regression modelling equations, are considered as independent variables. In this way, it can show the relationship between variables in the model in order to suggest the fitness of the hypothesised theory.

[30] Kano and Miura (2003), Kojima (2004), Schumacher and Lomax (2004), Tabachnich and Findel (2001) and Toyoda (2004)

Tabachnick et al (2001) described SEM modelling as the combination of exploratory factor analysis and multiple regression analysis. She explained this relationship using the following example of a simple model of multiple regression and Structural equation modelling (see Figure 8.1). All four of the measured variables in the boxes are connected by lines with arrows. The score of the entrance exam, gender, and caffeine (the independent variables) predict the graduate school success of students. A line with two arrows refers to a correlation between the independent variables. The residual shows imperfect prediction.

Figure 8.1: Path diagram of multiple regression

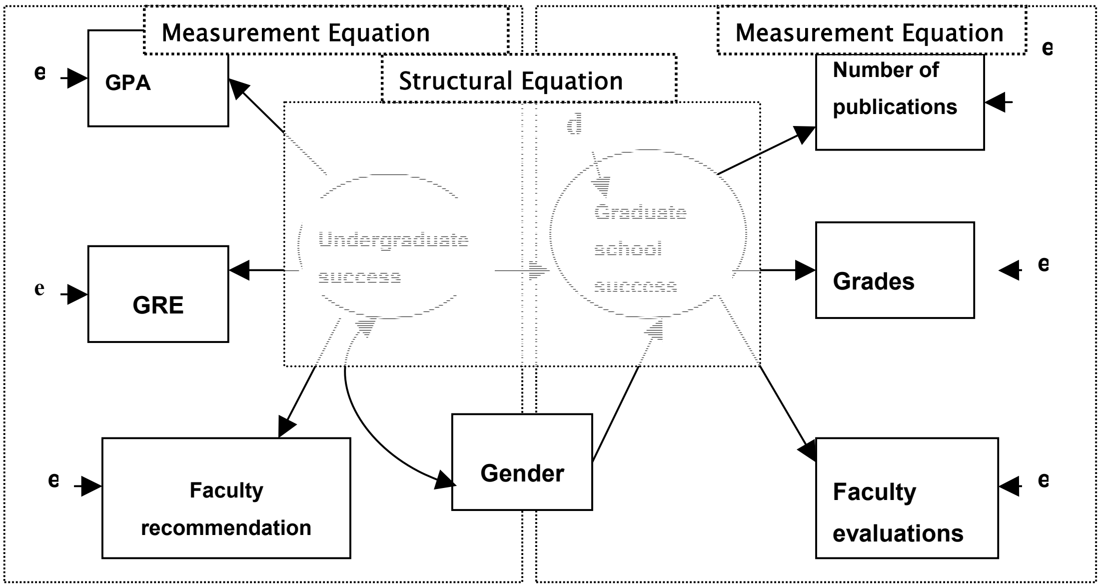


Source: Tabachnick et al (2001)

Note: This model estimates and examines the relationship between variables (the score of the entrance examination, gender of students and average daily caffeine consumption) and the Students' school graduate success

In SEM, measured variables which are called "observed variables" and "indicators" are represented by squares or rectangles. Factors that have two or more indicators are called "latent variables" or "unobserved variables" and are represented by circles or ovals. A relationship between variables is indicated by lines; the lack of a line connecting variables implies that no direct relationship has been hypothesised. A line with one arrow represents a hypothesised direct relationship between two variables, and a line with two arrows represents a correlation relationship between two variables. The variable with the arrow pointing to it is the dependent variable. Latent variables (latent factors) are variables that are not directly observable or measured. They are deduced from a set of measurable variables, which are called "observed variables". A regression model consists only of observed variables where a single dependent observed variable is predicted or explained by one or more independent observed variables.

Figure 8.2: Path diagram of structural modelling



Source: Using multivariate statistics (Tabachnick et al, 2001)

Note: The latent variables or unobserved variables are represented by circles or ovals, the observed variables by squares or rectangles. "e" and "d" represent " errors " or residuals.

Tabachnick illustrates SEM using the path diagram in Figure 8.2, in which "Success in Graduate School" is a latent variable that is predicted by gender (measured variable) and under graduate success (a factor). The construct factor predicts measurement variables. The Graduate School Success drives or creates the Number of publications, Grades or Faculty evaluations. The construct factor is not measurable, so it is obtained by measuring many observed variables which is a similar logic to factor analysis. "Gender" and "Undergraduate success" are independent variables in the model while the others are all dependent variables.

In the following section, the mechanism of SEM is explained using Schumacher and Lomax's examples.

8.2 The mechanism of Structural Equation Modelling

The idea behind SEM is that a hypothesised model has a set of underlying parameters which correspond to (1) the regression coefficients, and (2) the variance and covariances of the independent variables in the model. These parameters are estimated from the sample data to be "best guesses" about population values. The estimated parameters are then combined by means of covariance algebra to produce an estimated population covariance matrix. This estimated covariance matrix is compared with the sample covariance matrix and, ideally, the difference is very small and not statistically significant.

The structured population covariance matrix $\approx$ the sample covariance matrix.

Covariance algebra is used for calculating variance and covariance in SEM models. It shows how parameter estimates are combined to produce an estimated population covariance matrix for a small sample. The following are the important equations of SEM.

Equation 8-1 The important equations of SEM

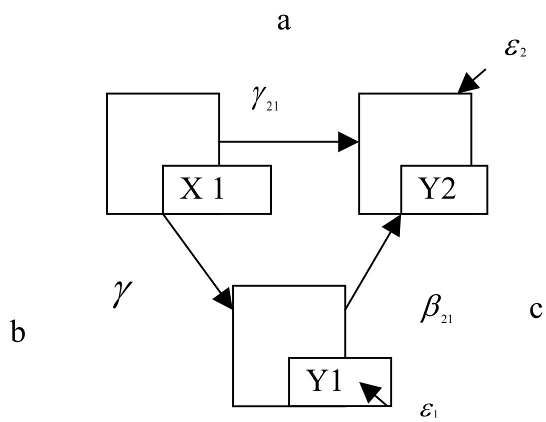
1. COV (C, X_1) = 0 (8.1)
2. $COV(cX_1, X_2) = cCOV(X_1, X_2)$ (8.2)
3. $COV(X_1 + X_2, X_3) = COV(X_1, X_3) + COV(X_2, X_3)$ (8.3)

In words,

1. The covariance between a variable and a constant is zero.
2. The covariance between two variables where one is multiplied by a constant is the same as the constant multiplied by the covariance between the two variables.
3. The covariance between the sum (or difference) of two variables and a third variable is the sum of the covariance of the first variable and the third and the covariance of the second variable and the third. In SEM, as in multiple regressions, we assume that the residuals do not correlate with each other or with other variables in the models.

A simple example of the covariance algebra of structural equation modelling is now explained using the Tabachnick model.

Figure 8.3: The example of path diagram



Equation 8.2 The structural model equation 1

Y1 = $\gamma_{11}X1 + \varepsilon_1$ (8.4)

Y2 = $\beta_{21}Y1 + \gamma_{21}X1 + \varepsilon_2$ (8.5)

The covariance between X1 and Y1 is computed as follows.

Cov (X1, Y1) = COV (X1, $\gamma_{11}X1 + \varepsilon_1$)

= COV(x1, $\gamma_{11}x1$) + COV(x1, ε_1)

=COV (x1, $\gamma_{11}x1$) = $\gamma_{11}COV(X1, X1)$ (8.6)

, where γ_{11} is the path coefficient of X and COV (X1, X1) is the variance of X1.

∵ As there are no covariance between errors and other variables, COV(x1, ε_1) = 0

COV (Y1, Y2) = COV ($\gamma_{11}X1 + \varepsilon_1, \beta_{21}Y1 + \gamma_{21}X1 + \varepsilon_2$)

=COV ($\gamma_{11}X1\beta_{21}Y1$) + COV ($\gamma_{11}X_1\gamma_{21}X_1$) + COV ($\gamma_{11}X_1\varepsilon_2$)

+ COV ($\varepsilon_1\beta_{21}Y_1$) + COV ($\varepsilon_1\gamma_{21}X_1$) + COV ($\varepsilon_1\varepsilon_2$)

= COV ($\gamma_{11}X1\beta_{21}Y1$) + COV ($\gamma_{11}X_1\gamma_{21}X_1$) (8.7)

Because the error terms ε_1 and ε_2 do not correlate with any other variables.[31]

All of the estimated covariances in the model could be derived in the same manner; but as is apparent, even in this small example, covariance algebra can be used to estimate parameters and then a population covariance matrix estimated from them. Estimated parameters provide us the estimated population covariance matrix.

The structural model given by Equation.8.4 and 8.5 can be represented in matrix form as:

Equation 8.3 The structural model equation in matrix form

$$\begin{pmatrix} y_1 \\ y_2 \end{pmatrix} = \begin{pmatrix} \gamma_{11} \\ \gamma_{21} \end{pmatrix} x_1 + \begin{pmatrix} 0 & 0 \\ \beta_{21} & 0 \end{pmatrix} \begin{pmatrix} y_1 \\ y_2 \end{pmatrix} + \begin{pmatrix} \zeta_1 \\ \zeta_2 \end{pmatrix}$$

$$y = \Gamma x + \mathrm{B} y + \zeta \qquad (8.8)$$

where y is a p x 1 vector of observed endogenous variables

x is a q x 1 vector of observed exogenous variables

B is a p x p coefficient matrix that relates endogenous variables to each other

Γ is a p x p coefficient matrix that relates endogenous variables to endogenous variables

ζ is a p x 1 vector of disturbance terms where

$COV(y) = \varphi$ is the p x p covariance matrix of the disturbance terms

$COV(X) = \phi$, the q x q covariance matrix for exogenous variables

The elements of B and Γ represent the structural relationships among the variables.

8.3 The process of Structural equation modelling (SEM)

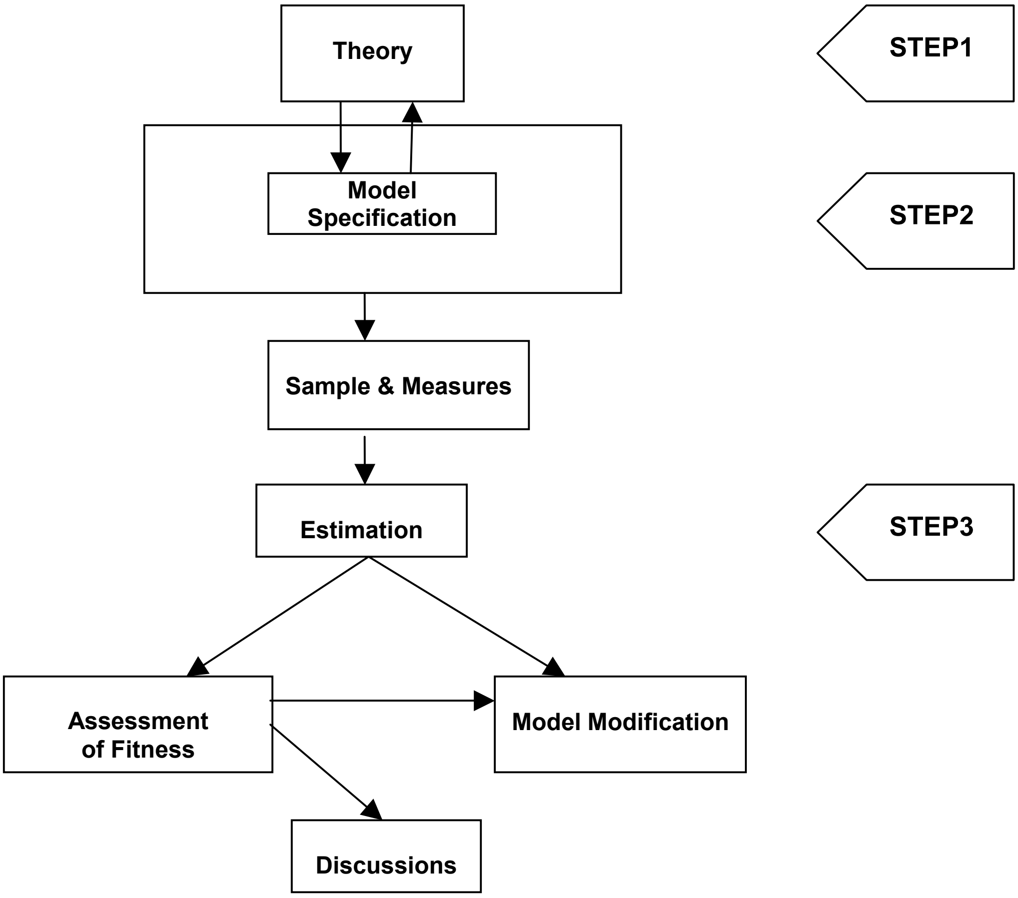
Findel (2001) stated that SEM is a confirmatory technique in contrast to exploratory factor analysis. It is used most often to test the theory which is already acknowledged

[31] Note: COV ($\varepsilon_1 \varepsilon_2$) = 0

by evidence. Therefore, previous knowledge or hypotheses about potential relationships among variables are required for SEM analysis. This is the major difference between SEM and other multivariate statistical techniques. Thus, planning driven by theory and estimation of parameters are essential to any SEM analysis.

In this section, the process of SEM analysis is described using Schumacher and Lomax's diagram.

Figure 8.4: Diagram of the Conventional approach to Structural Equation Modelling



Source Schumacher and Lomax (2004)

8.3.1 STEPS 1 and 2: Theory and model specification, hypothesised model

The researcher specifies a model that should be confirmed with variance-covariance data. The goal is to determine the best possible model that generates the sample covariance matrix. The sample covariance matrix S implies some underlying, yet unknown theoretical model or covariance structure. The researcher needs prior research and theories to choose among reasonable explanations and specify a model, ie, to develop an implied theoretical model (model specification). The exclusion of important or inclusion of unimportant variables will produce implied models that are miss-specified. A miss-specified model may result in biased parameter estimates and estimates that are systematically different from the true model. This bias is known as specification error, so that a more appropriately specified model may be evaluated in the model modification process. The identification is required to be investigated before the estimation of parameters in SEM on the basis of the sample data contained in the sample covariance matrix S and the theoretical model implied by the population covariance matrix $\sum$.

8.3.2 STEP 3: Sample size and assessment of fitness

Sufficient sample size is needed to estimate parameters and determine model fit given the specific theoretical relationships among the latent variables in SEM. A saturated model with p variables has p (p+3)/2 free parameters. For example, with 10 observed variables, 10(10+3)/2 = 65 free parameters. If the sample size is small, then there is not enough information to estimate parameters in the saturated model for a large number of variables. The chi-square fit statistic and derived statistics such as Akaike's information criterion (AIC) and the root-mean-square error of approximation (RMSEA) cannot be computed. In addition, the fit of the independence model is required to calculate other fit indices such as the comparative fit index (CFI) and the normal fit index (NFI). SEM is based on covariances. Parameter estimates and chi-square tests of fit are also very sensitive to sample size. Therefore, the literature suggests inspecting the determinants of the covariance matrix. An extremely small determinant may indicate a problem with multi-collinearity or singularity. After model estimation, the residuals should be small and centred around zero. The frequency distribution of the residual covariances should be symmetric. In the confirmatory approach a specific theoretical model is hypothesised, data are gathered, tested for significance and checked whether they are acceptable or not. Only a limited number of theoretically different models are tested to determine which model the data fits best. A Chi-square difference test is then conducted to compare each of the alternative models. The aim of generating the model is to find a model that fits the data well statiscally, but that also should have practical and theoretical meaning. The following are the two criteria used in judging the statistical significance and substantive meaning of a theoretical model as found in the literature.

1. The non-statistical significance of the chi-square test and the root-mean square error of approximation (RMSEA) values, are widely used fit measures. The chi-square test indicates that the sample covariance matrix and the reproduced model-implied covariance-matrix are similar. An RMSEA value less than or equal to .05 is considered a good fit model. More than 1 is not acceptable.
2. The statistical significance of individual parameter estimates for the paths in the model, which are critical values (CR) computed by dividing the parameter estimates by their respective standard errors as a t-value. A tabled t-value of 1.96 at the 0.05 level of significance is commonly used.

8.3.3 Model modification and discussion

If the theoretical model is not as strong as one would like, then the next step is to modify the model and evaluate the new modified model. In order to determine how to modify the model, there are a number of procedures available for discovering specification errors. By doing this, properly specified models may be evaluated. During these processes, it is meaningful to know how the default model is modified and then compare the results of alternative modified models. This is the most different characteristic of Structural Equation Modelling compared to other multivariate statistical analysis.

In the following section, SEM analysis of the Tokyo routes is undertaken.

8.4 Structural Equation Modelling analysis of the Tokyo routes

8.4.1 Background of the model

The Tokyo market has been changed during the process of deregulation. The relationship between influencing factors has been revealed as one of the outstanding features of air transport deregulation in much of the literature. Based on the analysis of the Tokyo routes in chapter 6 which focused on these factors, the results were summarised in Tables 6.20 and 6.21 (supra, chapter 6). In chapters 6 and 7 the different experiences in the Tokyo routes market were demonstrated and compared with those in the intra-European market. Key differences in the Tokyo routes market were as follows:

1. Traffic volumes were not increased significantly.
2. Some of the routes experienced increased frequencies.
3. Load factors decreased.
4. The highest fares decreased by 10%.
5. The highest discount fares increased by between 2% and 26%.
6. Lowest fares increased by 10% to 20%.
7. Even on the routes with new entrants operating, fares increased and load factors decreased.

8.4.2 Objectives of the Structural equation modelling analysis

The objectives of the SEM are to model and hopefully reproduce the results obtained from the study in chapters 6 and 7 and the relationships among factors, which were revealed as the key determinants of the structure of the deregulated air transport market with respect to the Tokyo routes.

There are five main reasons for adopting SEM to pursue these objectives:

1. It allows the importance of each factor in the model to be evaluated and the process of the model modification to be carried out.
2. A theoretical model can be tested using SEM that hypothesises how sets of factors define constructs, which cannot be observed by variables, and how these constructs are related to each other.
3. It is unique that all the variables, which are used in regression modelling referred to in academic literature, are considered as independent variables in the model and it can show the relationship between variables in the model. For example, both traffic volume and fare are independent variables in this model, although traffic volume is the dependent variable in traditional demand equations.
4. The relationship is represented and illustrated visually by the path model. The illustrated model, each path and the estimated parameters of factors are assessed statistically using several measures of the "goodness of fit".

5. It is meaningful to know how the default model is modified and the results of an alternative modified model are compared. This is the most different outcome of SEM compared to other multivariate statistical analysis techniques (Findel, 2001).

8.4.3 Hypothesised theory and data

This analysis was conducted using SPSS and AMOS software in order to fulfil the above objectives. The model is specified based on hypothesised theory in order to analyse the Tokyo routes so as to pursue the main objectives of this research (c.f. supra, chapter 1). The basic path model for the analysis of the Tokyo routes is illustrated in Figure 8.4 using basic concepts for the relationship between factors (see Figure 1.2 in chapter 1). Derived from these concepts and the results of the aforementioned analysis in chapters 6 and 7, the following theory is hypothesised:

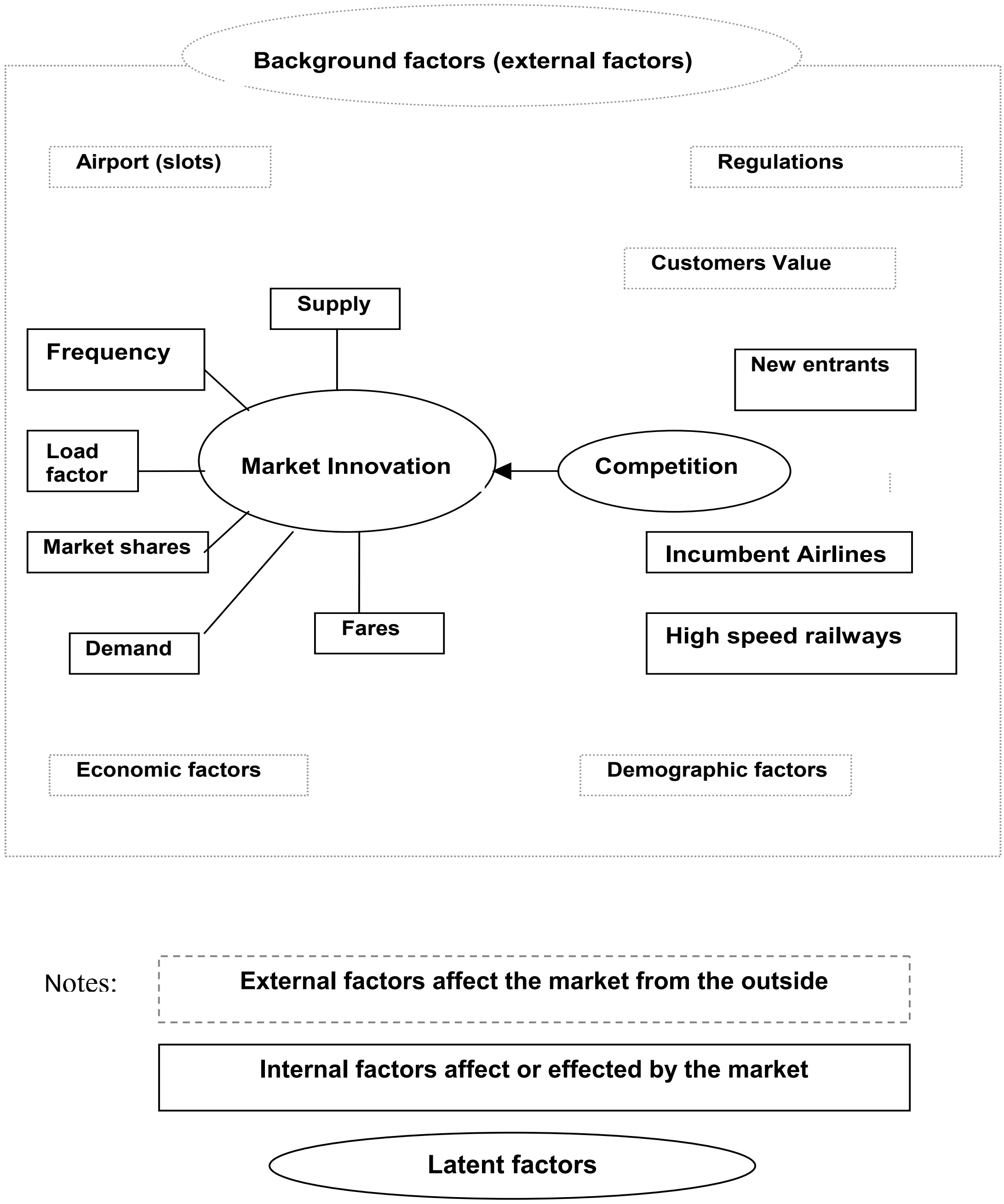
Following the process of deregulation of domestic air transportt in Japan from 2000 to 2003, the Tokyo routes hav eexperienced develoment by several key elements (changes of supply, demand, load factors and fares, new entrants and competition). "Market innovation" will be explained by several factors, representing these key elements. Besides, the prominent feature of deregulation, "Competition" influences "market innovation" (see Figures 1.2 in chapter 1 and 8.4 in chapter 8).

For this modelling, the data sample size is 134, representing all the Tokyo routes from 2001 to 2003. Primary data sample size is 220 covering the period 1999 to 2003. Primary data for the analysis was obtained from the Ministry of Land, Infrastructure and Transportation Statistics.[32] In addition, the schedule data and fares were collected from the timetables of each airline as submitted to the JCAB. The combined data sets have over 2,421 cases from 2001 to 2003.

Appendix K: Matrix of factors on the Tokyo routes by category in 2000;
Appendix L: Matrix of factors on the Tokyo routes by category in 2001;
Appendix M: Matrix of factors on the Tokyo routes by category in 2003.

[32] see http://toukei.mlit.go.jp/koukuu/koukuu.html

Figure 8.5: Basic concepts for the path model based on Figure 1.2



8.4.4 The hypothesised model and analytical structure

The sample size needs to be sufficient to estimate parameters and determine model fit given the specific theoretical relationships among the latent variables in SEM. In this case, the sample size is 134 and the two latent variables are named "Market innovation" and "Competition". Demographic and economic factors will be included in the analyses of the Tokyo domestic route market, which has sufficient sample size.

From the matrix, which was produced from the descriptive study of Tokyo routes, 10 factors are selected for the SEM analysis. These 10 observed variables are extracted and composed of two components using the exploratory factor analysis with Varimax rotation. Based on the result of this component matrix, Model 1 is specified. The observed variables are as follows:

Table 8.1: Observed variables

psincdep	**percentage increase of departures over the previous year on each route**
psincpax	**percentage increase of the number of passengers over the previous year on each route**
psinclodf	**percentage increase of load factor over the previous year on each route**
psincseat	**percentage increase of supplied seats over the previous year on each route**
incpslowf	**percentage increase of lowest discount fare over the previous year on each route**
Incpmaxdis	**percentage increase of highest discount fare over the previous year on each route**
diffmaxlow	**Discount percentage of lowest fares over the highest fares on each route**
HHI	**Hirshmann-Herfindahl Index**
nrairlne	**Number of airlines operating on each route in each year**
nrnewent	**Number of new entrants operating on each route in the year**

Unobserved, endogenous variables: Market innovation

Unobserved, exogenous variables: competition, e1, e2, e3, e4, e5, e6, e7, e8, e9, e10, e8, d1 (residuals)

Notes: HHI is an index which is a commonly accepted measure of market concentration. It is calculated by summing the squared market share of each firm competing in a market.

8.4.5 Estimation and model modifications

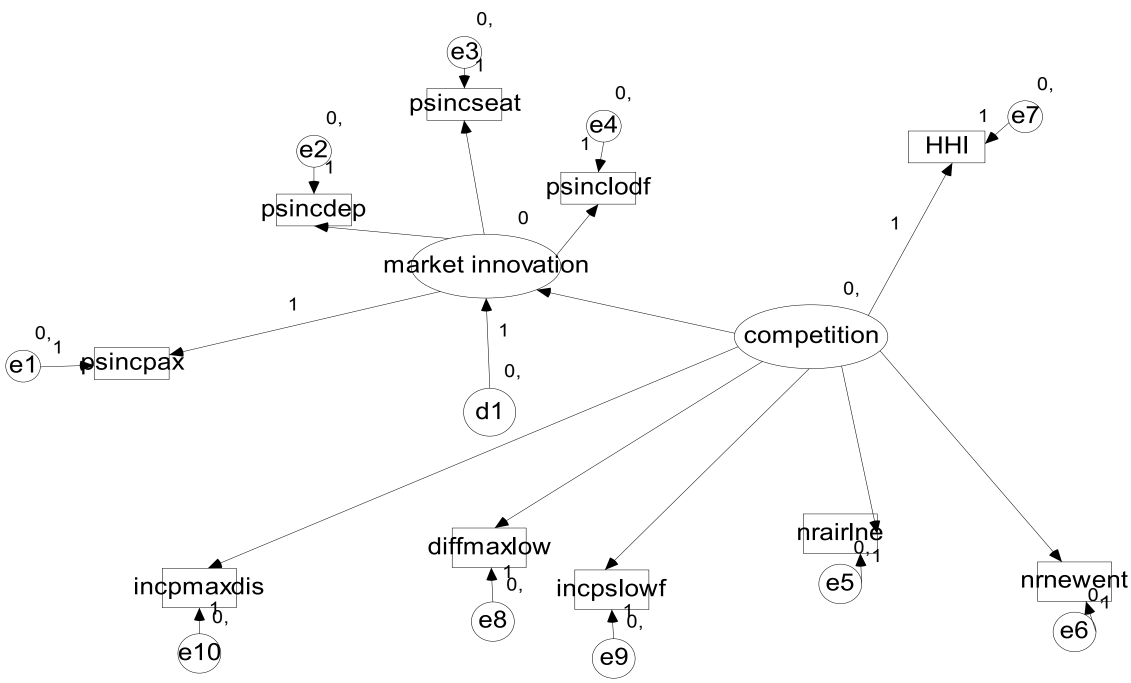
8.4.5.1 Model 1: the default model

This is the basic model, which has two latent variables, "Market innovation" and "Competition". It is the unique point and the strength of SEM that the relationship between the dependent variables and independent variables in the demand equation model is represented in the model simultaneously. Model 1 is specified according to the assumption that fare factors could be more related to "Competition". However, the results of statistical indices rejected this model (see Figure 8.5).

The results of statistical goodness of fit indices are as follows:

$\chi^2 = 527.936$ df = 34 and P = 0.000. CFI = 0.581, RMSEA= 0.330 and AIC = 589.936

Figure 8.6: Model 1, the default model



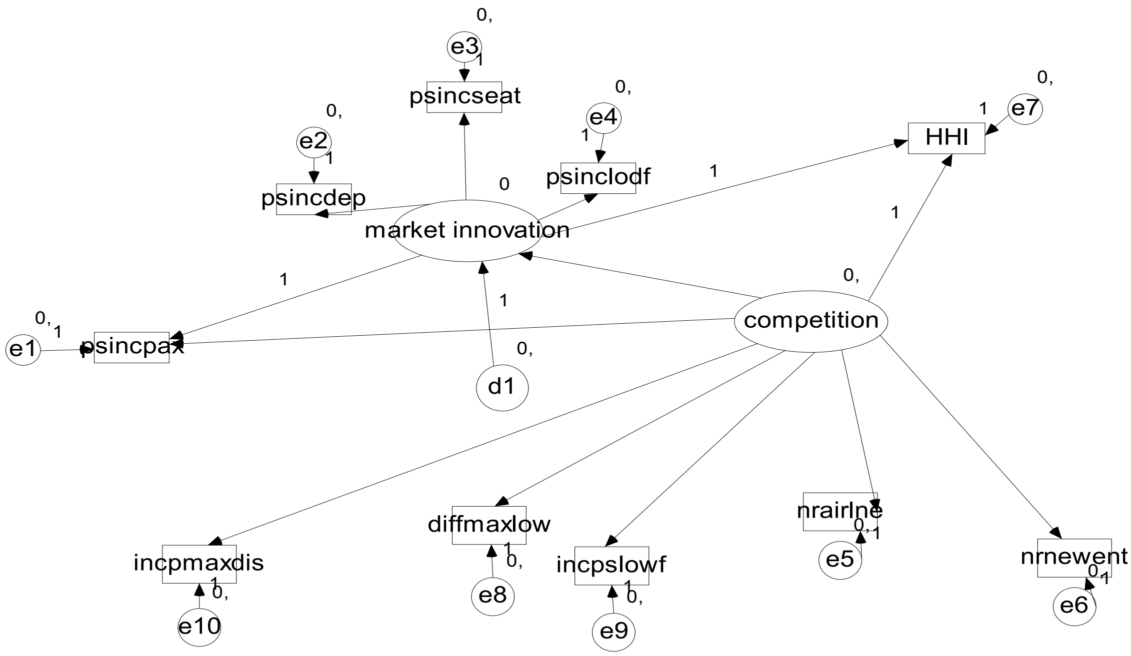
8.4.5.2 Model 2: Direct path to the number of passengers and market consentration (HHI)

In demand equations, fare is one of the important variables to determine the number of passengers. In Model 2, the direct relationship between fares and demand (the number of passengers) is added by drawing the path. Moreover, a direct relationship between “Market innovation” and market concentration (HHI) is added. To avoid the un-identification of this model, the regression coefficients of these three variables are fixed at 1. As the relationship between these variables could be shown in this model, these factors are connected with other supply factors, which are “the number of supplied seats” and “the number of departures”, which are linked to HHI. The result of Model 2 is as follows:

$\chi^2 = 665,39$ df = 33 and P = 0.000. CFI = 0.464, RMSEA= 0.380 and AIC = 729.393

The statistical fitness indices still reject this model. The Chi-squared index shows more negative results. However, the indices, RMSEA and AIC have improved a little. Therefore, the basic idea of this model is kept.

Figure 8.7: Model 2

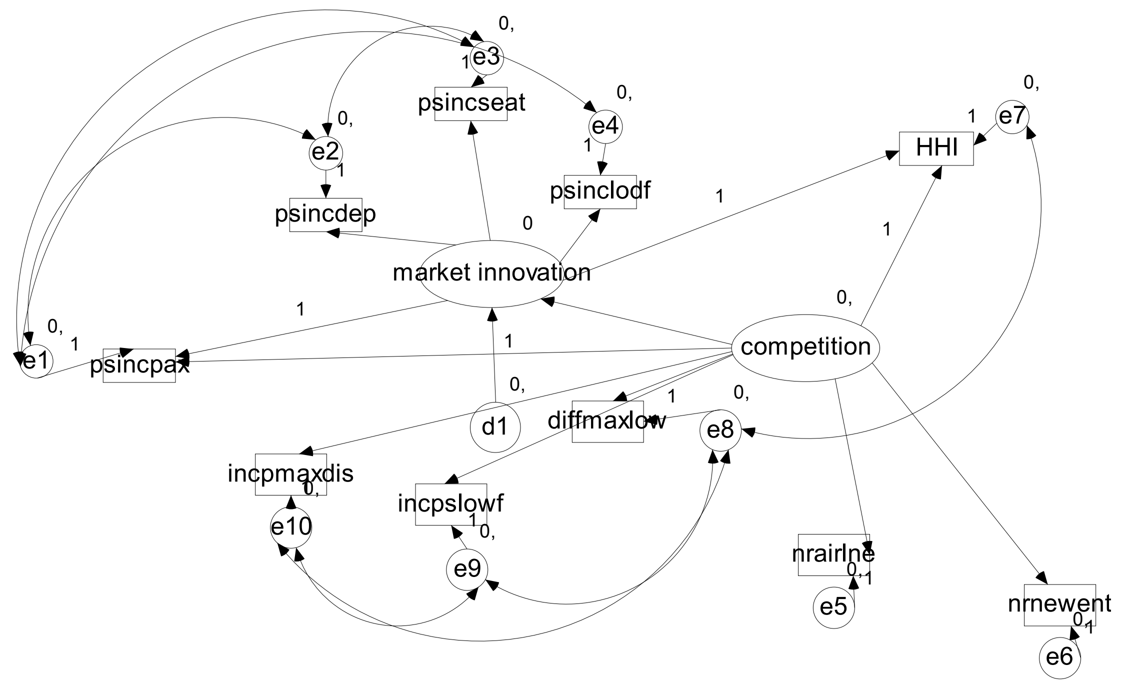


8.4.5.3 Model 3: Relationship between observed variables

Based on the assumption that fare factors could have a more closed relationship with each other, the residual of fare factors is connected by two arrow lines. In addition, the relationship between "the number of supplied seats" and "the number of departures", "the number of carried passengers "and "load factor" could be important. Thus, residuals of these factors are connected by two arrow lines in Model 3. It is assumed that the difference between the most expensive fares and the lowest discount fares has a relationship to HHI. Therefore, residuals of these variables are also connected in Model 3. The results of statistical goodness of fit indices of Model 3 are as follows:

$\chi^2 = 70.455$, from 665,393 of Model 2 and 527.936 of Model 1, which is much improved: df = 11 and P = 0.000. CFI = 0.961, RMSEA = 0.117 and AIC = 150.455

Figure 8.8: Model 3



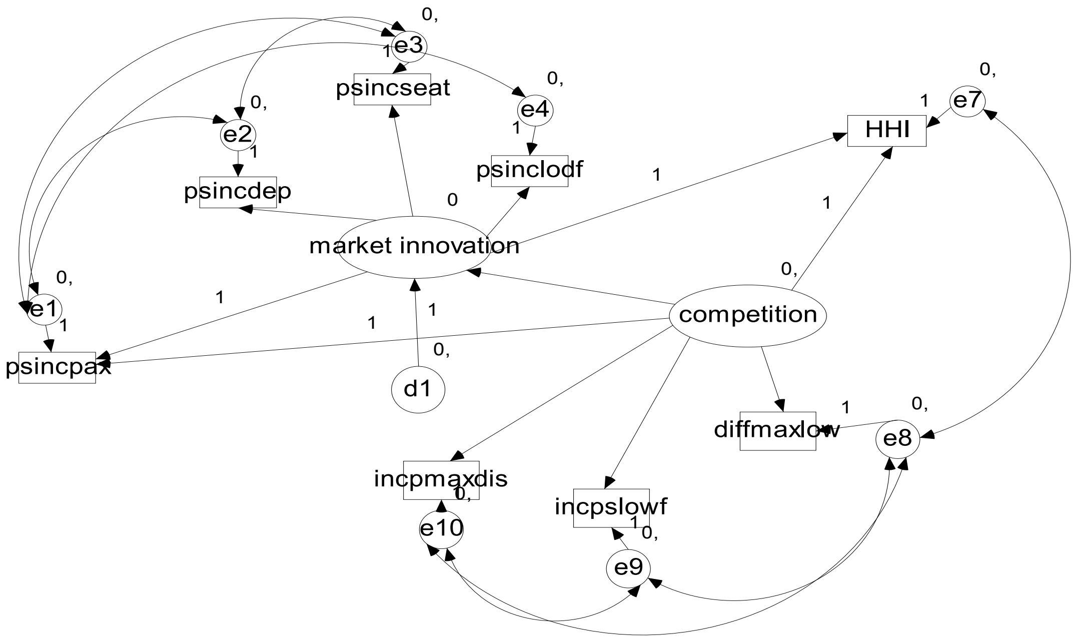
8.4.5.4 Model 4: To eliminate the factors, the number of new entrants and airlines

On all the Tokyo routes, the number of new entrants is still limited even after full deregulation. So assuming that the number of new entrants has not affected competition in the overall market much, the observed variable "number of new entrants" will try to be eliminated in Model 4. Moreover, as most routes in the Tokyo market are still supplied on an oligopoly or monopoly basis, the number of airlines is also removed. The result is as follows:

$\chi^2 = 26.242$ df = 11 and P = 0.006, CFI = 0.981, RMSEA = 0.102 and AIC = 92.242

These model fit indices suggest that the sample data have an acceptable fit to the combined measurement model. However, variances between some residuals are not positively defined in the results (e7 and e8, e8 and e9, e8 and e10). For the next model 5, two arrows between these residuals are removed.

Figure 8.9: Model 4



8.4.5.5 Model 5

The model fit indices of Model 5 suggest that the sample data have an acceptable fit to the combined measurement model ($\chi^2 = 28.0$, df = 14, p = .014, CFI = .983, RMSEA = .087 and AIC = 88.028). Therefore, Model 5 is adopted as the result.

Figure 8.10: Model 5 (un-standardised model)

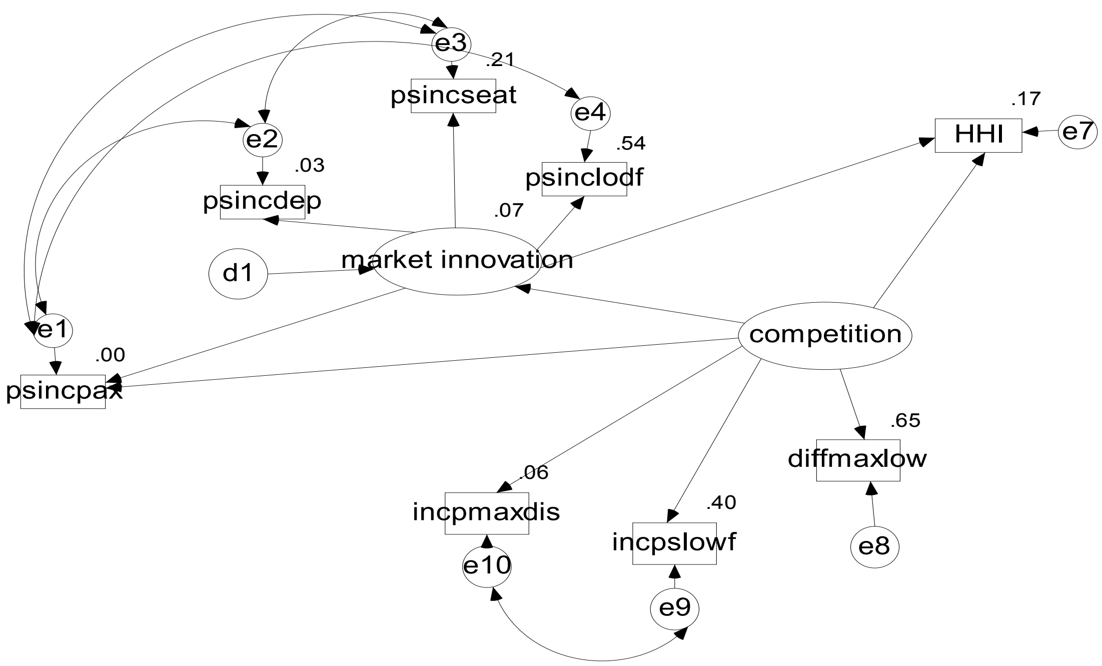
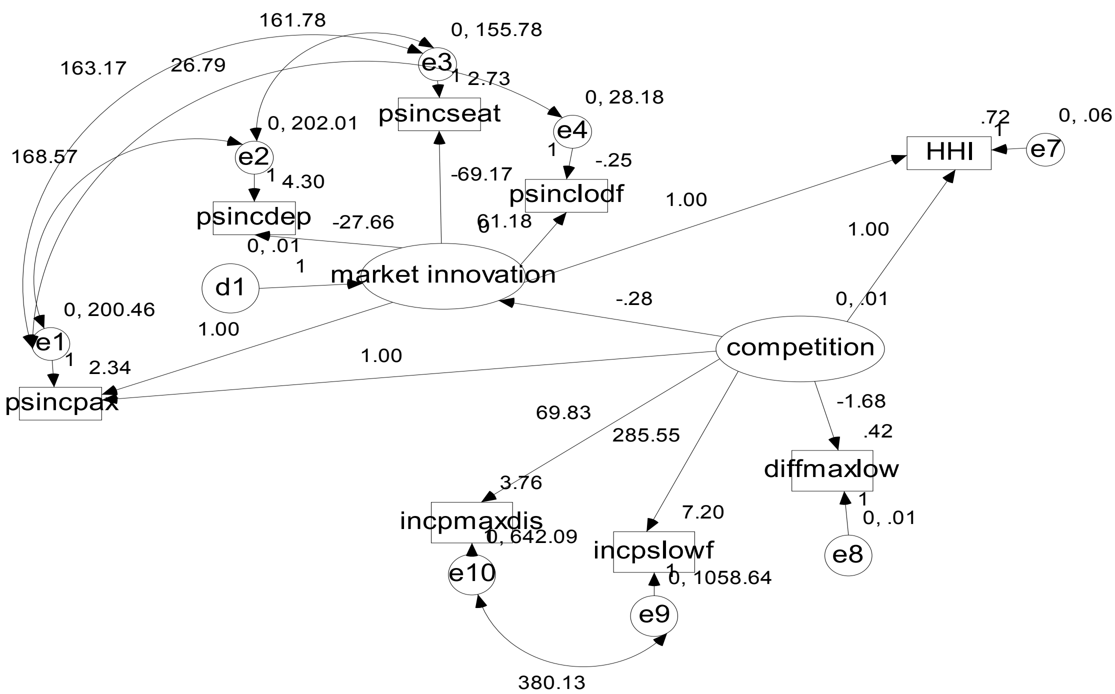


Figure 8.11: Model 5 (standardised model)



8.4.6 Assessment of fitness of the model

Table 8.2 shows the goodness of fit of each model. According to the results of selected fit indices, Model 5 is the most acceptable.

Table 8.2: Goodness of fit of each model

	Chi-square statistic			CFI	NFI	RMSEA	AIC
Model	**Chi-square**	**Degrees of freedom**	**Probability level**	**Acceptable >0 .95**		**Good fit < 0.008 Reject > 1.0**	**Smaller AIC is better**
Model 1	**527.936**	**34**	**.000**	**.581**	**.569**	**.330**	**589.936**
Model 2	**663.393**	**33**	**.000**	**.461**	**.457**	**.380**	**729.393**
Model 3	**67.947**	**24**	**.000**	**.963**	**.945**	**.117**	**149.947**
Model 4	**26.242**	**11**	**.006**	**.981**	**.969**	**.102**	**92.242**
Model 5	**28.028**	**14**	**.014**	**.983**	**.967**	**.087**	**88.028**

For Model 5 the chi-square statistic, technically a measure of badness of fit, is equal to 28.0, with 14 degrees of freedom and a p value of .014. The root- mean-square error of approximation (RMSEA) is equal to .087, which is an acceptable level of this measure of fit, RMSEA < 1.0. Besides, NFI (Bentler-Bonett normed fit index) and CFI (comparative fit index) are .967 and .983 respectively, which are at acceptable levels for these measures of fit (criterion CFI >.95 and both CFI and NFI mean better fitness the closer to 1.0).

Across this particular set of model fit indices, the conclusion is that the data-to-model fit is approaching a reasonable level (see Table 8.3).

There are many arguments in the literature regarding the interpretation of model fit criteria and acceptable fitness indices of SEM. Table 8.3 summarised these criteria covered by the literature.

Table 8.3: Model fit criteria and Acceptable Fit Interpretation

Model Fit Criterion	Acceptable level	Interpretation
Chi-square	Tabled chi-square value	Compares obtained chi-square value with table value for given DF
Tucker- Lewis index	0 (no fit) to 1 (perfect fit)	Value close to .95 reflects a good model fit
Normed fit index	0 (no fit) to 1 (perfect fit)	Value close to .95 reflects a good model fit
Root-mean-square error of approximation (RMSEA)	< .05 (good fit model) > 1.0 (not acceptable)	Value less than .05 indicates a good model fit Value more than 1.0 indicates the model is not acceptable
Akaike Information criterion (AIC)	0 (perfect fit) to negative value (poor fit)	Compares values in alternative models

Source: This table is compiled by the author based on the criteria of Schumacher and Lomax (2004), Arbuckle (2005), and Yamamoto and Onodera (2002).

8.4.7 Summary and discussion

According to the process and the result of the SEM analysis, an acceptable specified model (Model 5) has been derived. The hypothesised relationships among demand factors are drawn and the path diagram is accepted and supported sufficiently by several model fit indices. The strong relationship between the number of passengers and competition is supported by the direct path from "Competition". However, the effect of competition is not so prominent in this model, because the estimate value is -.276, which is negative and its CR (Critical ratio) is below 1.96 (e.g. it is not significant). This indicates the effect of "Competition" on "Market innovation" is not significant. Interestingly, it is demonstrated by the result of this model that the new entrants did not significantly affect the Tokyo market after all. The regression weight of "incpmaxdis" (percentage increase of highest discount fares over the previous year) is estimated to be 69.8. This means that "incmaxdis" goes up by 69.8 when competition goes up by 1. It demonstrates that the highest discounted fares have been going up even after deregulation. Moreover, the regression weight of "incplowf" (percentage increase of prices of the lowest fares) is estimated to be 285.551 and that of "diffmaxlow" – 1.682. The lowest fares went up and the discount percentage of lowest fares compared to the highest fares went down when competition went up by 1. Much academic literature has demonstrated that the lowest fares are lower and departure frequencies are higher on fully liberalised routes. However, the outcome of this analysis indicates the opposite result with respect to the Tokyo routes after deregulation. This indication is extremely interesting and the path models permit theoretically meaningful relationships to be drawn between variables. Nevertheless, some CR (Critical ratio) values of regression weights are not significant. In addition, strictly speaking, the value of RMSEA has a possibility to be improved according to Arbucke (2005). He mentioned that there is also the opinion that a value of about .08 or less for the RMSEA would indicate a reasonable error of approximation.

Considering again the results of the aforementioned descriptive analysis of the Tokyo routes, the results of 2000 and 2003 were significantly different from each other (see Appendix H and Appendix J). Therefore, it is assumed that more appropriate results will be available by further study with additional samples and variables over a longer period (2000-2005), including economic and demographic variables to investigate the effect of deregulation on the market overall.

8.5 Structural equation modelling analysis of competition between air transport and high speed rail

In this section, the relationship between the Time index and the Fare index in the air transport market serving Tokyo is examined and analysed using Structural Equation modelling (SEM). The objectives of this SEM analysis are to model and validate the results of the analysis in chapter 4 and the relationships between the factors, which were revealed as the key determinants of air transport competition with HSR in Japan.

8.5.1 Hypothesised theory

According to the process of deregulation of domestic air transportt in Japan from 2000 to 2003, the Tokyo routes have experienced development by several key elements (changes of supply, demand, load factors and fares, new entrants and competition with HSR). "Market innovation" will be explained by several factors, which represent these key elements. Moreover, the prominent feature of deregulation, "Competition" influences "market innovation" (see Figures 1.2 in chapter 1 and 8.4 in chapter8).

8.5.2 Data and variables

The primary data covers the month of April for the years from 2000 to 2005. The data for analysis was obtained from the Ministry of Land, Infrastructure and Transportation Statistics[33]. The schedule data and fares used were collected from the timetables of each airline and the data provided by JCAB. For the fare index and time index data, the result of chapter 4 is adopted. The combined data sets have over 2,706 cases covering 2003 and 2005.

Table 8.4: Observed variables in the time and fare index study

frequency	**Percentage change of departures over the previous year on each route**
demand	**Percentage change of the number of passengers over the previous year on each route**
Load factor	**Percentage change of load factor over the previous year on each route**
supply	**Percentage change of supplied seats over the previous year on each route**
fareindexlow	**Fare index of the lowest discount fare**
fareindexdisc	**Fare index of the highest discount fare**
fareindexpeak	**Fare index of the highest fare**
fareindex	**Fare index of the fully flexible fare**
timeindex	**Time index**
newentrants	**Number of new entrants**
Stage length	**Distance from Tokyo to destination**

Unobserved, endogenous variable: Market development
Unobserved, exogenous variable: Competition
Residuals: e1, e2, e3, e4, e5, e6, e7, e8, e9, e10, e11, d1.

8.5.3 Results and summary

Figure 8.11 and Table 8.5 show the best modified model (Model 6) and the results of estimated standardised regression weights. They demonstrate the situation of the Tokyo routes market, where competition between air and high-speed rail has not affected and developed the market dramatically, even after deregulation (regression weight of competition: 0.081). The "New entrants" and "load factor" variables were eliminated

[33] see http://toukei.mlit.go.jp/koukuu/koukuu.html

during the model modification process. The time index (regression weight: 0.355) is not a big factor in this model, which shows that the high-speed railway network is already well established in the Tokyo market and competition between air transport and HSR is already severe. The highest fares (regression weight: 0.98) and fully flexible fares (regression weight: 0.823) have affected the market rather than the discount fares (regression weight: 0.737) and lowest fares (regression weight: 0.585). The results of this analysis demonstrate the situation on the Tokyo routes where the market has been affected by high fares rather than discount and low fares even after deregulation. This is because of the lack of very low fares in the market. The fares in the markets with new entrants were increased and the average difference between the highest fares and lowest fares was only 35% (see Tables 6.18 and 6.19). In this SEM analysis, the results of chapters 4, 6 and 7 are confirmed: (1) the Tokyo route market was not developed significantly, (2) the highest fares decreased by only 10% and the discount fares increased, (3) New entrants did not affect demand in the market (see Tables 6.20, 6.21, 7.11 and 7.12).

Table 8.5: Model modification

	χ^2	DF	Prob.	GFI	CFI	RMSEA	AIC
Default model	**467.2**	**43**	**0**	**.674**	**.471**	**.349**	**513.2**
Model 2	**135.9**	**26**	**0**	**.771**	**.775**	**.228**	**173.8**
Model 3	**80.9**	**19**	**0**	**.818**	**.859**	**.2**	**114**
Model 4	**75.0**	**18**	**0**	**.83**	**.87**	**.198**	**111**
Model 5	**26.7**	**17**	**.62**	**.931**	**.978**	**.094**	**64.7**
Model 6	**12.1**	**16**	**.739**	**.965**	**1.0**	**1.0**	**52**

Figure 8.12: Competition model of the Tokyo routes

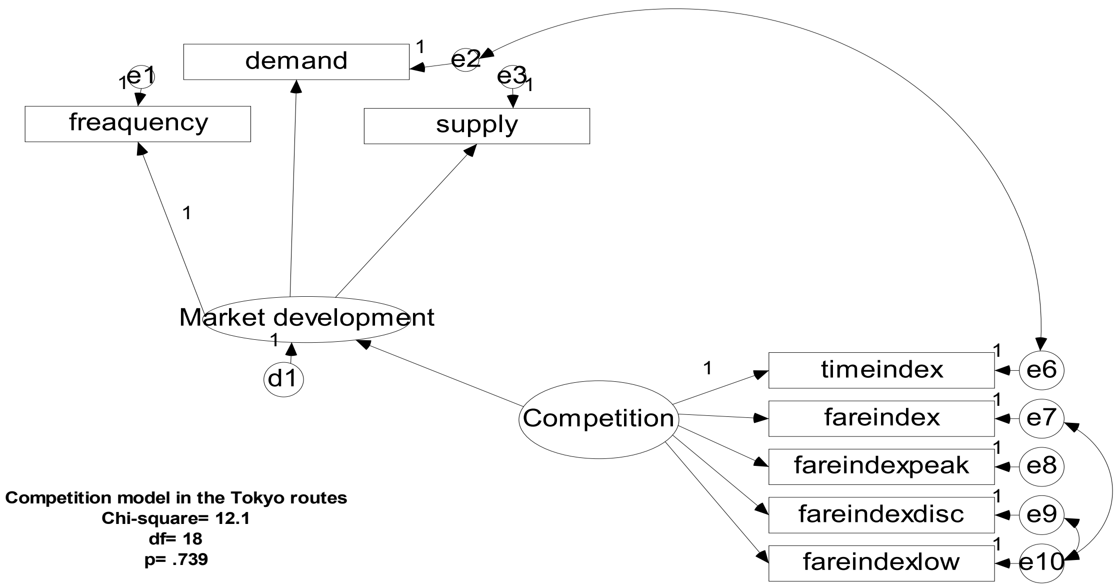


Table 8.6: Summary of the results; Standard regression weights (model 6)

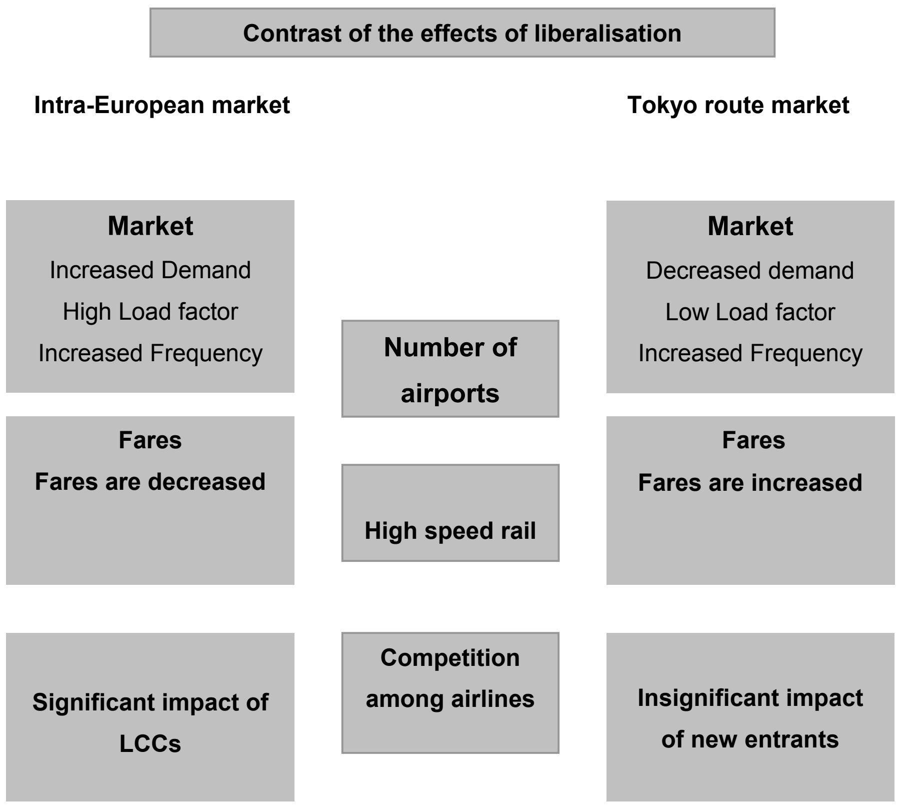
	Market development	Competition	Squared multiple Correlations
Market development		.081	.007
frequency	.944		.892
timeindex		.355	.126
fareindex		.823	.677
fareindexpeak		.98	.961
fareindexdisc		.737	.544
fareindexlow		.585	.342
demand	.878		.771
supply	.846		.715

Chapter 9: Constraints for liberalisation of the air transport market in Japan

9.1 Deregulated market outcomes

In the previous chapters three remarkable outcomes of liberalisation in Japan were identified by using several internal factors which affect the market (see Figure 1.2 and 8.4): (1) decreased demand, (2) increased fares and (3) new entrants' failures. Investigations of the causal relationship between them reveal that these three results of liberalisation in the Tokyo route market are caused by several constraining factors. Figure 9.1 contrasts the different effects of liberalisation in the Intra-European market and the Tokyo routes market.

Figure 9.1: Contrast of the effects of liberalisation between the intra-European market and the Tokyo route market



The market and fares of Tokyo routes, and competition between airlines and high speed rail were investigated in chapters 4, 5 and 6. In chapter 7 LCCs' impact on the intra-European market is compared with that on the Tokyo routes. These results show the three major differences between Japan and the intra-EU market: (1) Number of airports serving the routes, (2) competition with HSR, and (3) the levels of competition among airlines. In this chapter, the aim is to discover the factors which caused the different experiences in the Tokyo routes market and which acted as constraints even after liberalisation by analysing these external factors (see Figure 1.2 and 8.4) such as airports and airlines' activities. The analysis demonstrates how these factors have affected each other in the Japanese air transport market. In the following sections, the airport system and its financial structures are analysed and the airline's activities are discussed in order to discover the reasons of different experiences from those of the intra-EU market.

9.2 Airports in Japan

This section aims to discover the relationship between airport development and the results of liberalisation in the market. To this end, airports in Japan are investigated in order to understand the airport system in Japan and the relationship between Government policy and airport development. This analysis focuses on the management body and its structure, the way in which the airports in Japan have been developed and financed, and how Government policy has affected airport development.

9.2.1 Airports in Japan and their management body

The total number of airports with paved runways in Japan was 145 in 2006.[34] Of these, 57 airports are mainly for public air transportation in Japan, where the country area size is about 0.4 million sq km which is slightly smaller than the state of California in the United States and the Japanese population is about 127 million currently.

[34] The total number of airports with paved runways in the following countries in 2006: UK 471, France 477, Italy 133, Germany 554 and the US 14,858.

In Air law in Japan, “Airport” is defined as “a Public airfield” for air transport and categorised mainly into three groups as follows in Article 2.1 of the Airport development law.

Airport Development Law, Article 2.1

1. *Category 1 airport: Narita International Airport, Chubu International Airport, Kansai International Airport and other international airports which are essential for international air transport routes.*
2. *Category 2 airport: Airports, which are essential for major domestic air transport routes.*
3. *Category 3 airport: Airports, which are essential for securing regional air transport services.*

The major international Category 1 airports in Japan, such as Narita International Airport, Chubu International Airport and Kansai International airport, are managed by individual “Public corporations”[35]. Other airports, such as Haneda airport and Osaka International airport in Category 1 and some Category 2 airports are managed by the central Government authority (Ministry of Infrastructure, Land and Transportation). Other Category 2 and Category 3 airports are administrated by the local governments, where each airport is located. At several airports, such as Tokushima and Komatsu, which are controlled by the Ministry of Defence or the US Air Force, some parts of the facilities at these airports were constructed and managed by the Ministry of Infrastructure, Land and Transportation (MILT) (see Table 9.1).

[35] It refers to the privatised organisation, which used to be owned by Government through “the social cooperation law”. In the case of Narita airport, when the Narita airport cooperation law was legislated in 2004, New Tokyo International Airport Authority was privatised and changed its name to the Narita International Airport cooperation. However, its capital is owned 100% by Government.

Table 9.1: Management bodies of airports in Japan

<table>
<tr><th rowspan="2"></th><th colspan="4">Category 1 Airport</th><th rowspan="2" colspan="2">Category 2 Airport</th><th rowspan="2">Category 3 Airport</th></tr>
<tr><th></th><th>Narita</th><th>Kansai</th><th>Chubu</th></tr>
<tr><td>Establishment</td><td rowspan="3">Government (MILT)</td><td>NAA</td><td>KIA</td><td>Centrair</td><td colspan="2">Government (MILT)</td><td>Local Public Body</td></tr>
<tr><td>Management</td><td>NAA</td><td>KIA</td><td>Centrair</td><td>Government (MILT)</td><td>Local Public Body</td><td>Local Public Body</td></tr>
<tr><td>Fundamental Facilities (Runway, Taxiway and Apron)</td><td>NAA</td><td>KIA</td><td>Centrair</td><td>Government (MILT)</td><td>Local Public Body</td><td>Local Public Body</td></tr>
<tr><td>Air Traffic control facilities</td><td colspan="7">Government (MILT)</td></tr>
<tr><td>Terminal Buildings</td><td>Private</td><td>NAA</td><td>KIA</td><td>Centrair</td><td>Private</td><td>Private</td><td>Local Public Body Private</td></tr>
</table>

Source: Ministry of Land, Infrastructure and Transport (2005)

Notes: NAA (Narita International Airport Corporation), KIA (Kansai International Airport Co., LTD) and Centrair (Central Japan International Airport Co., Ltd)

The specific information about airports in Japan including locations and the length of runways are referred to in the following appendices.

Appendix E: Main airports in Japan

Appendix F: Main airports in Japan (map)

9.2.2 Airport development plan and financial structure of airports

Airports in Japan have been developed and constructed under "the Airport Development Law" of 1956, which aimed to establish a domestic air transport network in Japan. The airport development plan was established under this law.

"The first Airport Development Five year Plan" was launched in 1967 and "the Airport Development Special Account" was legislated in 1970 in order to separate the financial accounts for airport development from the Government general account. "The Airport Development Special Account" aimed to develop the domestic air transport network in Japan and this objective was accomplished by establishing at least one airport for each prefecture until the 5th Airport development five year plan in 1990.

The 6th Plan from 1991 set another objective to increase the total runway length at airports in Japan. It was represented by the Total Runway Length Index[36], which aimed to increase this from 760 m to 800 m, compared to the 1,000 m average in the US and Europe at that time. This plan resulted in the development of the regional airports rather than the large airports in the metropolitan city areas.

The 7th Plan from 1996 focused on the development of the Metropolitan airports more than any others. It included the investigation of a new airport in the Nagoya area (Chubu Centrea airport) and the future possibility of a third airport in the Tokyo metropolitan area. This policy was established in order to compete with other Asian airports, such as Incheon airport in South Korea, Kuala Lumpur airport in Malaysia and Changi airport in Singapore, and was enforced more by the 8th Airport Development Plan which was started in 2003 (see Table 9.2).

[36] It is computed by the sum of the total length of runways / { population (millions)/ surface area (1,000 km²)} ½.

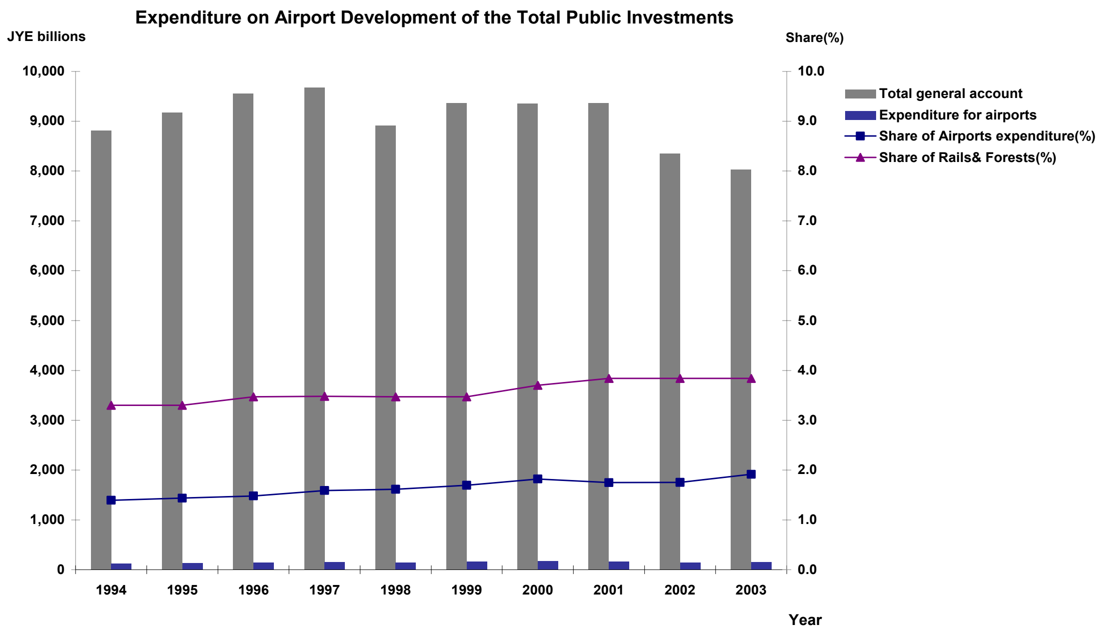
Table 9.2: The Airport Development Plans and their major objectives from 1967 to 2002

Airport Development Plan	Period	Major objectives	Number of jet airports /total
1st	1967-1970	Development of TYO and OSA Development of regional airport	7/56
2nd	1971-1975	Construction of NRT and KIX Development of Major airports and regional airports Construction of aviation safety facilities Promotion of anti- noise measurements	18/70
3rd	1976-1980	Promotion of airport environmental measurements Development of aviation safety facilities Development of NRT Investigation, planning and construction promotion of KIX Development of other airports	28/76
4th	1981-1985	Development of NRT Promotion of TYO development Promotion of KIX investigation Promotion of other airports Development of aviation safety facilities Promotion of airport environmental measurements	39/78
5th	1986-1990	Completion of NRT Opening of new runway at TYO Promotion of development of KIX Development of other airports Development of aviation safety facilities Promotion of airport environmental measurements	48/82
6th	1991-1995	Completion of the 2nd period airport facilities at NRT Investigation for opening KIX Development of other airports Development of aviation safety facilities Promotion of airport environmental measurements	54/90
7th	1996-2002	Completion of new runways at NRT and TYO Investigation for the 2nd development at KIX Investigation of NGO and new airports in metropolitan areas Development of other airports Development of aviation safety facilities Promotion of airport environmental measurements	57/96

Source: Ministry of Infrastructure and Transport (2005)

Figure 9.2 shows the total public investment of the Japanese Government's general account and the proportion of expenditure for airport development, and rail and forest development in the total. Although the share of airport development among the public investments has been slightly increasing after 2002, the share of expenditure for airport development was rather small (less than 2%) in comparison with 4% for train and forest development.

Figure 9.2: Expenditure for airport development compared with total public investments



Source: Author based on data of Ministry of Infrastructure, Land and Transport, Aviation statistics (2005)

The financial resources for airport development are supplied through "the airport development special account" from mainly five sources, which are (1) financial investment capital (the Japanese postal savings and pensions), (2) local government account, (3) airport charges (the landing charges and en-route navigation charges), (4) Government general account and (5) other resources including non-aeronautical revenue at each airport. The financial structure is illustrated as follows (see Figure 9.3). The General Account includes 85% of the total aviation fuel tax, which is paid by airlines and other aviation sectors. The rest of the income from fuel tax is used to pay for airport management.

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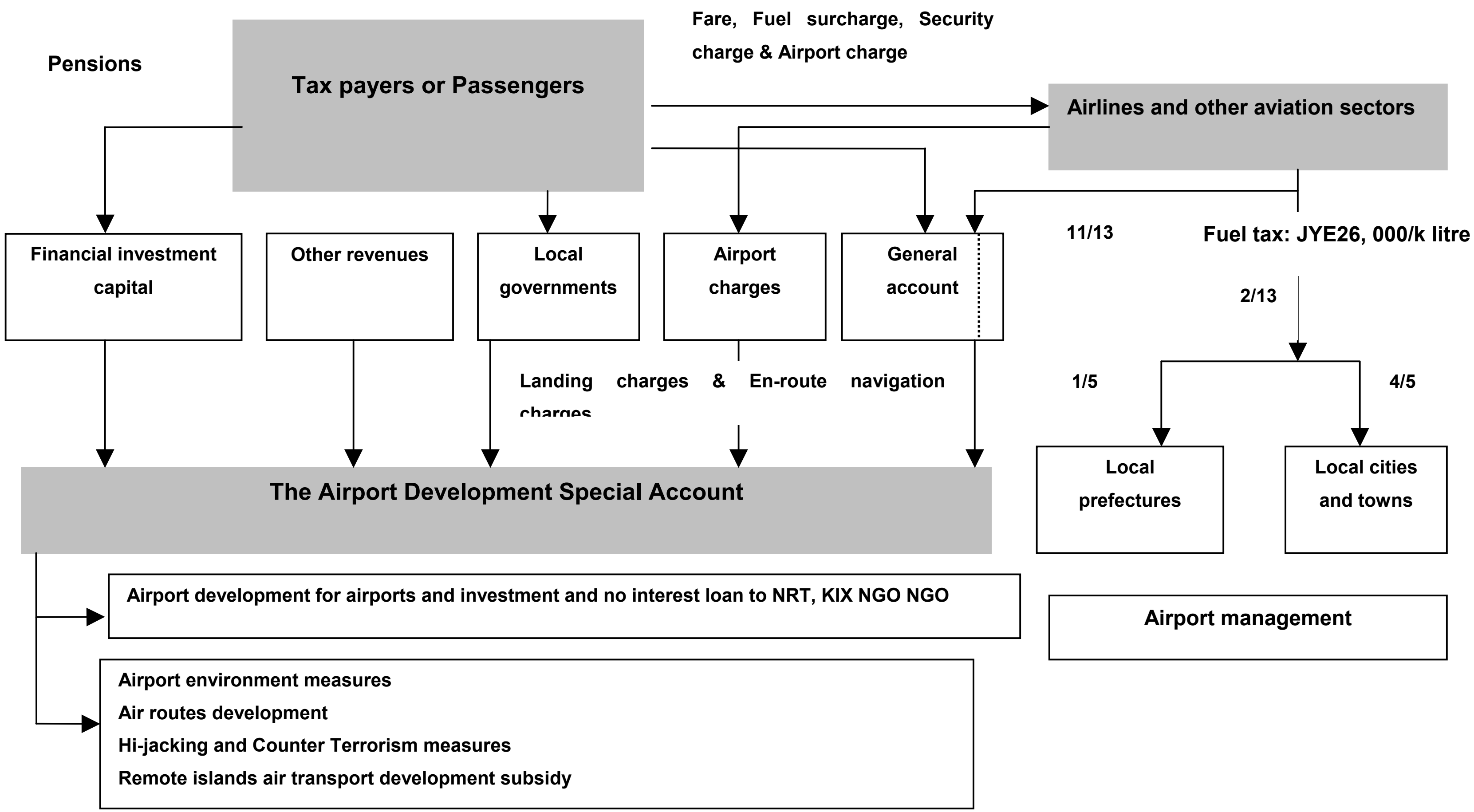
Figure 9.3: The structure of the airport development special account in Japan



Source: Ministry of Infrastructure, Land and Transport, Aviation statistics (2005)

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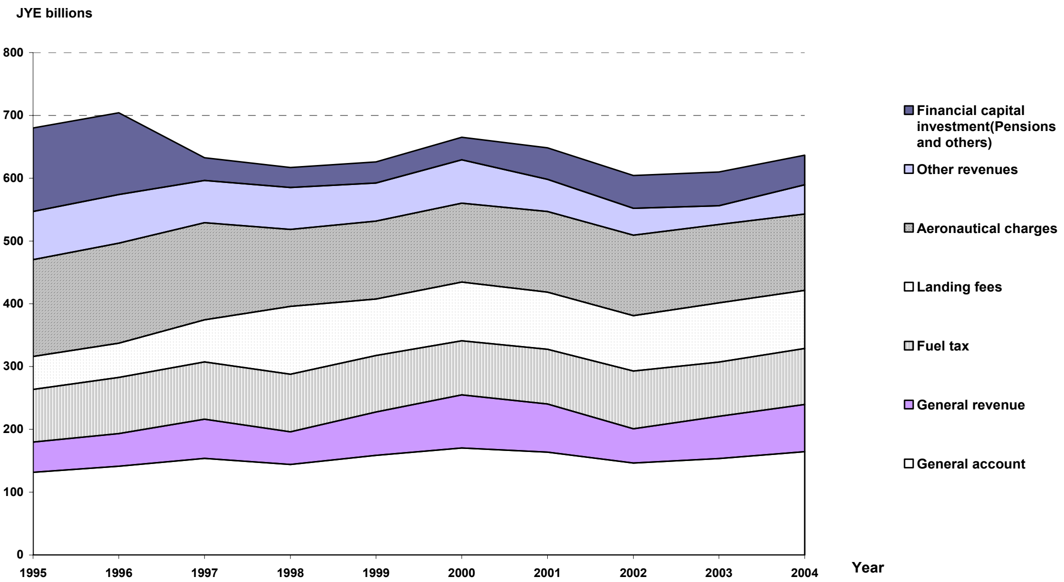
Figure 9.4 shows the evolution of the revenue structure of the Airport Development Special Account from 1995 to 2004. In 1995 and 1996 the proportion of capital investments from pensions and Japanese postal savings were very high at 24% (JYE 133 billion), but decreased to just under 10% during the following ten years. This was caused by the recession and deficit financing of the Government Treasury after the "Bubble economic boom" in Japan. As a result, the percentages from aeronautical charges, landing charges and fuel taxes in the airport development special account increased dramatically from 51% in 1992, to 54% in 1996 and to 64 % in 2004 (see Figures 9.5, 9.6 and 9.7). Fuel taxes are imposed in only Japan and the US. In 2000, USD 234/kiloliter was charged in Japan compared to USD 12/kiloliter in the US.[37] Fuel tax in Japan is extremely high compared to that of the US. These three costs are paid by airlines and aviation sectors, and are reflected in fares as a result.

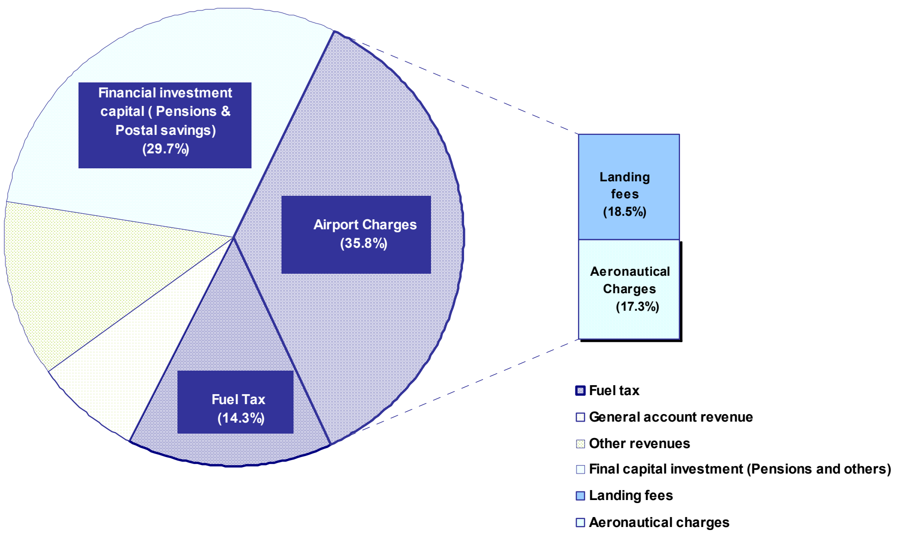
Figure 9.4: Revenue structure of the airport development special account



Source: Author based on data from Ministry of Infrastructure, Land and Transport, Aviation statistics (2005)

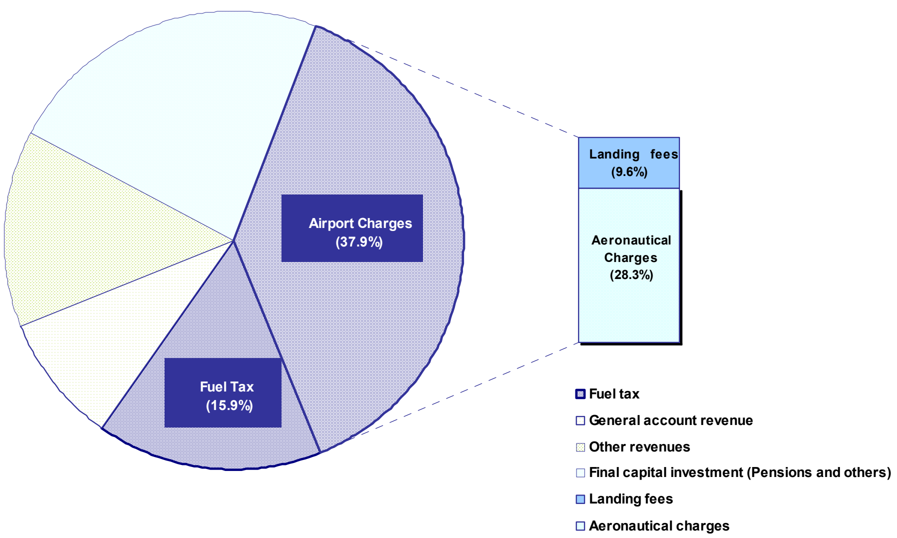
37 Source: Association of airlines in Japan (2001)

Figure 9.5: The airport development special account revenue in 1992



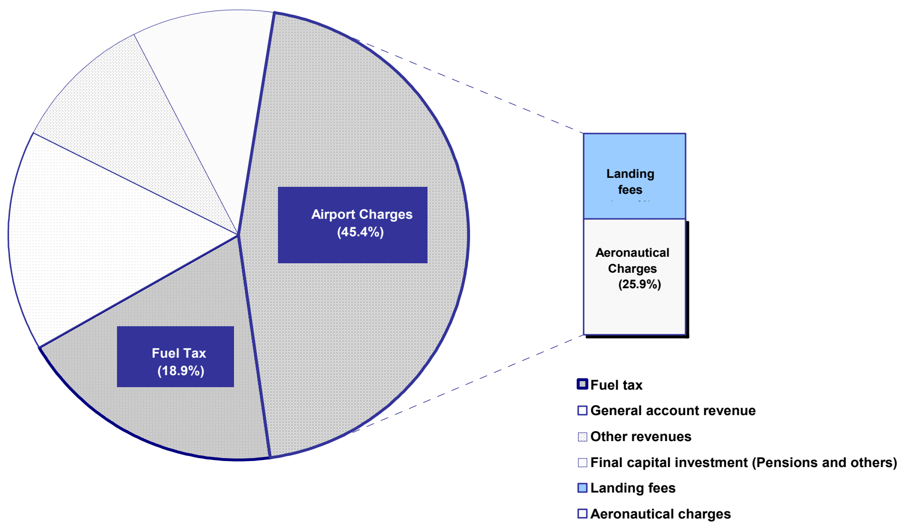
Source: Author based on data from Ministry of Infrastructure, Land and Transport, Aviation statistics (2005)

Figure 9.6: The airport development special account revenue in 1996



Source: Author based on data from Ministry of Infrastructure, Land and Transport, Aviation statistics (2005)

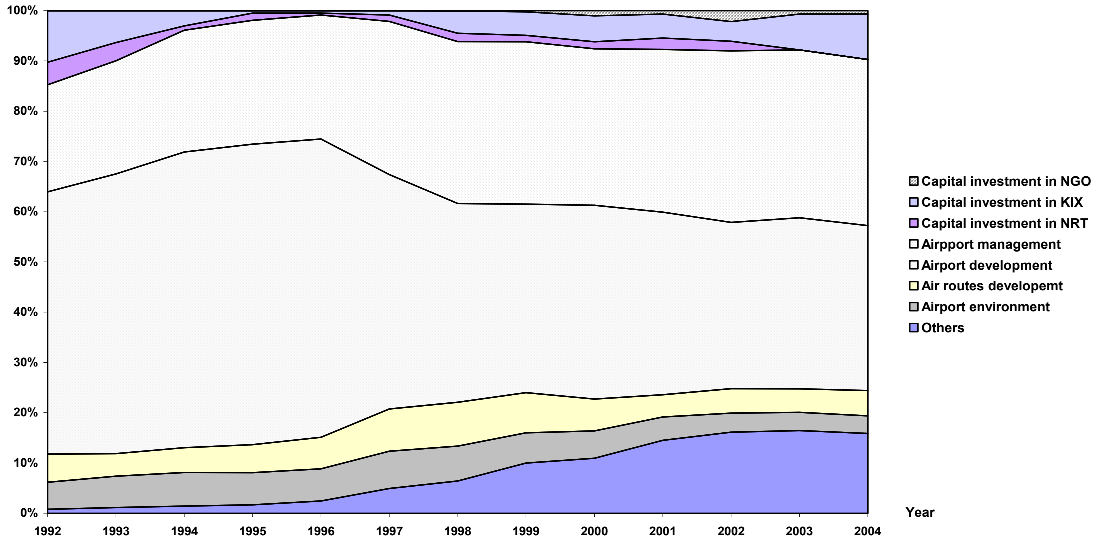
Figure 9.7: The airport development special account revenue in 2004



Source: Author based on data from Ministry of Infrastructure, Land and Transport, Aviation statistics (2005)

Figure 9.8 shows the expenditure structure of the airport development special account from 1992 to 2004, which reflects the major objectives of the airport development plans that were implemented during this period (see Table 9.2). Although Narita International airport, Haneda airport and Kansai International airport have been privatised, their capital investments for planning, construction and management have been supported by a part of the airport development special account. "Expenditure for air route development" is used for the establishment of aeronautical infrastructure and system, while "Airport environment expenditure" is allocated to the management and alleviation of environmental issues, including compensation for any kind of environmental loss and damage caused by airport construction and airport operations.

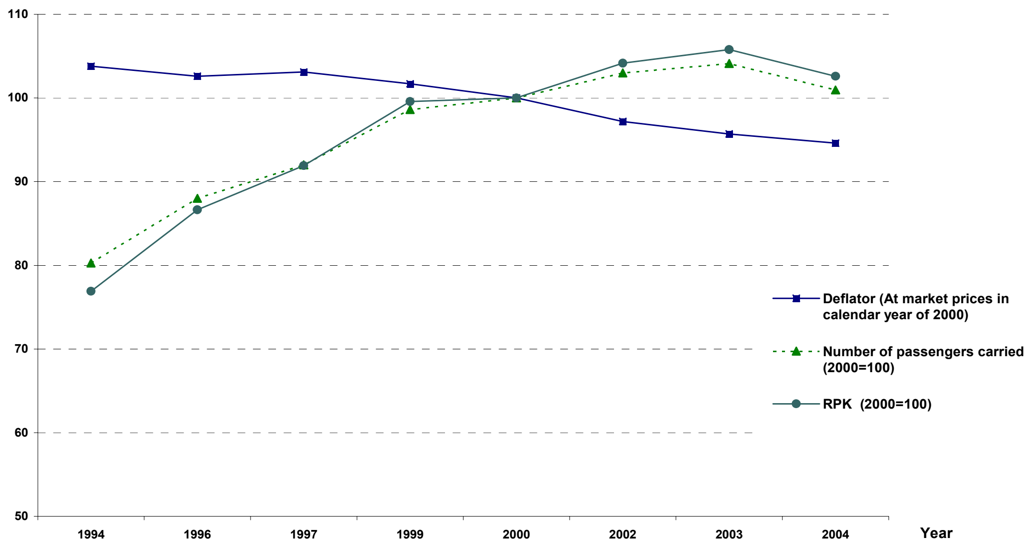
Figure 9.8: Expenditure structure of the airport development special account



Source: Author based on data from Ministry of Infrastructure, Land and Transport, Aviation statistics (2005)

Interestingly, Figure 9.8 shows the relative increase of expenditure for airport development, which covers construction and management of airports excluding NRT, KIX and NGO from 1992 to 1996. A total of 10 airports including new runways were constructed during this period, such as at Aomori (in 1990), Shonai (in 1991), Izumo (in 1991), Iwami (in 1993), Hiroshima-nishi (in 1993), Niigata (new runway in 1996), Sapporo (new runway in 1996), Kansai international (in 1996), Tokyo international (new runway in 1997), and Odate-noshiro (in 1998). These airports and runways were established under the objectives of the 6th airport development plan from 1991 to 1995 (c.f. supra, section 9.2 of chapter 9). This planning activity was reflected in the Government's promotion policy for competition, which was started in 1996 with the new fare setting rules and the Phase I slot allocation system at Haneda airport in 1997 in order to promote competition between airlines and improve consumers' convenience by expanding the air transport network serving the local regions (c.f. supra, section 2.2.2 and Figure 2.7 of chapter 2 and Figure 5.2 of section 5.1 of chapter 5). Figure 9.12 demonstrates the economic decline and the stagnation of air transport activities after 1999. While this promotion policy was planned during the economic boom in Japan from 1986 to 1993, it commenced during the following "lost decade in Japan" from 1991 to the beginning of 2000 with the start of the Phase I slot allocation system.

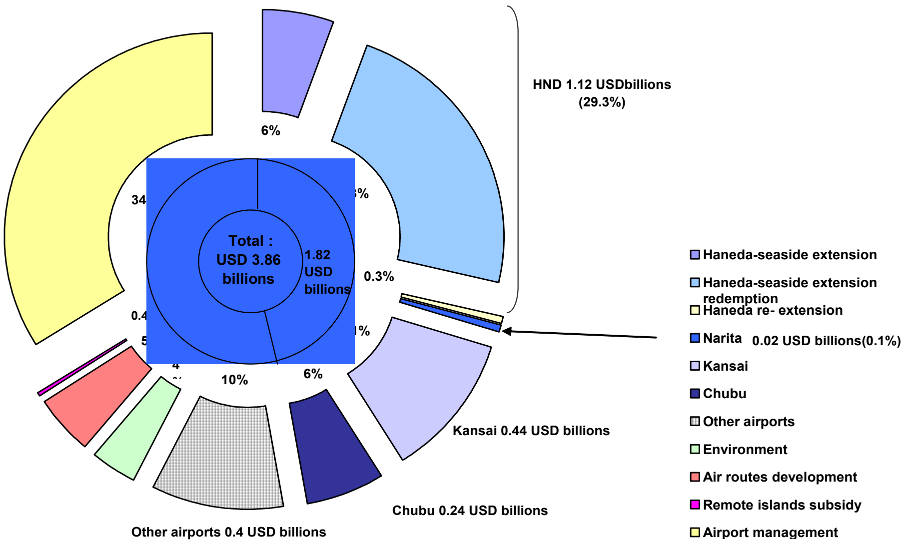
Figure 9.9: GDP deflator, the number of passengers and RPK in the Japanese domestic market (2000=100)



Source: Author based on data from Department of National Accounts, Economic and Social Research Institute, Cabinet Office (2006) and Ministry of Infrastructure and Transport, Aviation Statistics (1994 – 2004)

The 8th airport development plan established in 2003 aimed at the development of the main international hub airports, such as Haneda airport (TYO), New Tokyo international airport (NRT), Chubu international airport (NGO) and Kansai international airport (KIX) rather than other airports (c.f. section 9.2.2). This policy was reflected in the structure of expenditures in 2003 (see Figure 9.10). It shows that USD 1.82 billion out of a total of USD 3.86 billion expenditure was appropriated to the development of the main international hub airports including Haneda airport. This accounted for 47% of the total expenditure; 29% of the total amount was used for the development of the seaside extension at Haneda airport, its redemption and re-extension which will be competed in 2009.

Figure 9.10: Airport development special account expenditure in 2003



Source: Author based on data from Ministry of Infrastructure, Land and Transport, Aviation statistics (2005)

USD 1.12 billion was spent for the further development of Haneda airport 29% (USD 1.12 billion), which had a different financial resource structure than other airports. “The Haneda seaside extension project” was started in 1983 and completed in 2006 after the completion of the new C runway in 1997, the new B runway in 2000 and the second passenger terminal building in 2004 (see Table 9.3).

Table 9.3: Main scheme of the Haneda sea-side extension project

	1st project	2nd project	3rd project		
Main project Start of operation	A runway July 1983	1st terminal building Sep 1993	New C runway Mar 1997	New B runway Mar 2000	2nd terminal building 2004
Runway Before this project B runway 2,500 x 45 m C runway 3,150 x 60 m	A runway 3,000 x 60 m B runway 2,500 x 45 m C runway 3,150 x 60 m	A runway 3,000 x 60 m B runway 2,500 x 45 m C runway 3,150 x 60 m	A runway 3,000 x 60 m New B runway 2,500 x 60 m New C runway 3,000 x 60 m		

Source: Ministry of Infrastructure, Land and Transport (2005)

Another project, "the Haneda re-extension project" was commenced in 2000 in order to expand the number of slots at Haneda airport by establishing a new runway. The completion of this runway in 2009 enables an increase in the number of daily slots from 782 in 2007 to 1,114 in 2009. This project is financed by different sources compared to other airport development by adopting the PFI (the Private Finance Initiative, see below) method for constructing the terminal building and apron areas which involves the private bodies (see Table 9.4).

Table 9.4: Financial resource structure of the Haneda re-extension project

Project	Government (General account)	Local public body (no interest loan)	Financial investment capital fund (with interest loan)
Runway	**30%**	**20%**	**50%**
Terminal & apron areas		**PFI 100%**	

Source: Ministry of Infrastructure, Land and Transport (2007)

Note: PFI (The Private Finance Initiative) is a method to provide financial support for Public–Private Partnerships (PPPs) between the public and private sectors. The capital element of the funding enabling the authority to pay the private sector for these projects is given by central government in the form of what are known as PFI "credits". The loans are paid back over the period of the PFI scheme by the service provider who is at risk if the service is not delivered to standard throughout.The cost of this borrowing as a result is higher than normal government borrowing (but cheaper when better management of risks is taken into account) but does not all appear as borrowing in public accounts (source: The Cabinet office in Japan and Wikipedia).

The financial structures of the development of other airports are summarised in Table 9.5. Category 1 airports are fully financed by Government, while Category 2 (A) airports are funded 67% by the Government and 33% by local public bodies. In case category 2 airports re-develop facilities in order to promote public utility such as a new runway, they are categorised as Category 2 (B) airports to enable them to obtain 55% of Government financing. Category 3 airports are financed 50% by Government and 50% by local public bodies (see Table 9.5).

Table 9.5: Financial resources structure of airport development

Category of airport	Airport	Government	Local public body
1	Haneda* and Osaka	100%	0%
2 (A)	21 airports incl. Sapporo, Fukuoka	67%	33%
2 (B)	5 airports incl. Akita	55%	45%
3	5 airports incl. Aomori, Okayama	50%	50%

Source: Ministry of Infrastructure, Land and Transport (2007)

Note1: The financial resources for the Haneda re-extension development (the Re-extension project at Tokyo international airport) is excluded because it has a different policy adopted.

Most airports in Japan were constructed before the 45 and 47 system in 1970 and 1972 and developed their facilities in order to accept large aircraft by extending runways in line with the 1st to 6th (1967-1995) airport development plans. From the 7th Plan, the development of large hub airports was mainly envisaged with the process of air transport liberalisation of the domestic market. The following findings result from the analysis in this section.

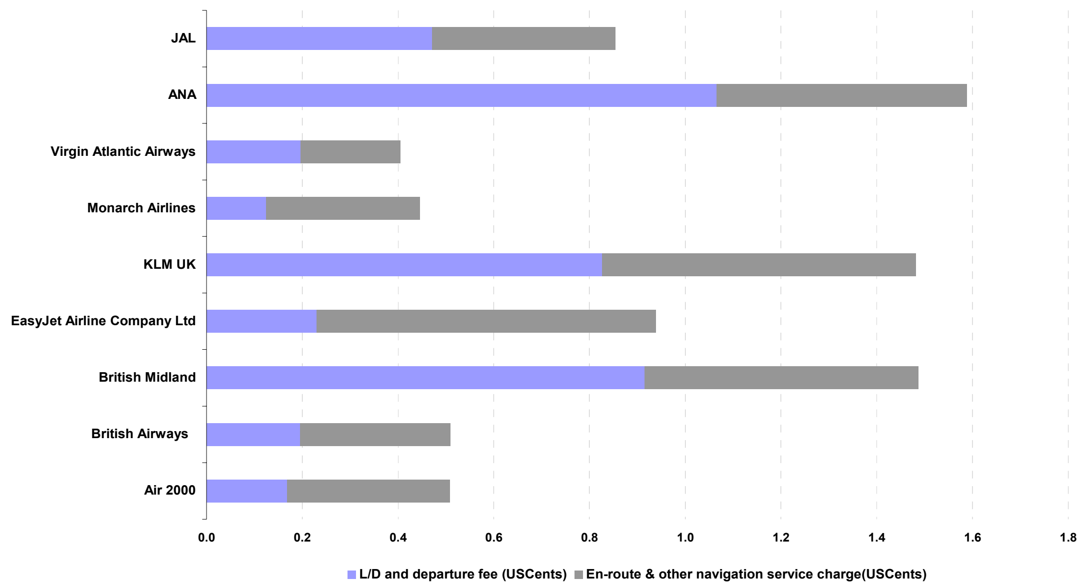
- The proportion for airport development (less than 2%) of total public investments in Japan is small compared with that of railways (4%).
- The financial resource for airport development and management is “the airport development special account”, which enables the subsidisation of unprofitable airports.
- 64% of the financial resource was covered by aeronautical charges, landing charges and fuel tax, which were paid by airlines and aviation sectors.
- 60% of the airport development special account expenditure was used for airport development.
- Many airports in the local regions were developed and secondary airports constructed during the 6th airport development plan from 1991 to 1995.

- These airport developments and the competition promotion policy of Government were established during the economic boom, but started in the recession.
- In order to compete with other Asian hub airports, the development has focused more on Metropolitan airports (TYO, NGO, KIX, NRT and the 3rd Tokyo area airports) than on other airports since 2003.

9.3 High yield products lift the costs in Japan

In the findings of the previous section, it was shown that more than 64% of the financial resource was covered by aeronautical charges, landing charges and fuel taxes which are paid by airlines. Figure 9.11 contrasts the aeronautical charge per ASK in 2004 between Japanese airlines and selected airlines in the UK. Especially it highlights the expensive landing charges of Japanese airlines. The proportion of landing charges of total aeronautical costs of easyJet is smaller because they make efforts to reduce these costs by negotiating with airports and reducing MTOW of aircraft, while en-route and air navigation charges are out of their control as they are charged based on fixed unit rates.

Figure 9.11: Aeronautical charge/ASK (US cents) in 2004



Source: Author based on data from UK CAA (2004) and ICAO (2004)

Note: British Airways's aeronautical charge is lower than others because of their longer sector length.

Examples of landing charges on Japanese domestic routes in 2005 are given in Table 9.6. Landing charges for a B-747-400, an aircraft widely used by Japanese network carriers, amount to USD 2,964 for a typical domestic flight and USD 4,747 for an international flight. En-route navigation charges for a B-747-400 on the Tokyo-Fukuoka route (881 kms) amount to USD 4,261 per sector and USD 827 for a B-737-500.

Table 9.6: Examples of landing charges on domestic routes in Japan (2005)

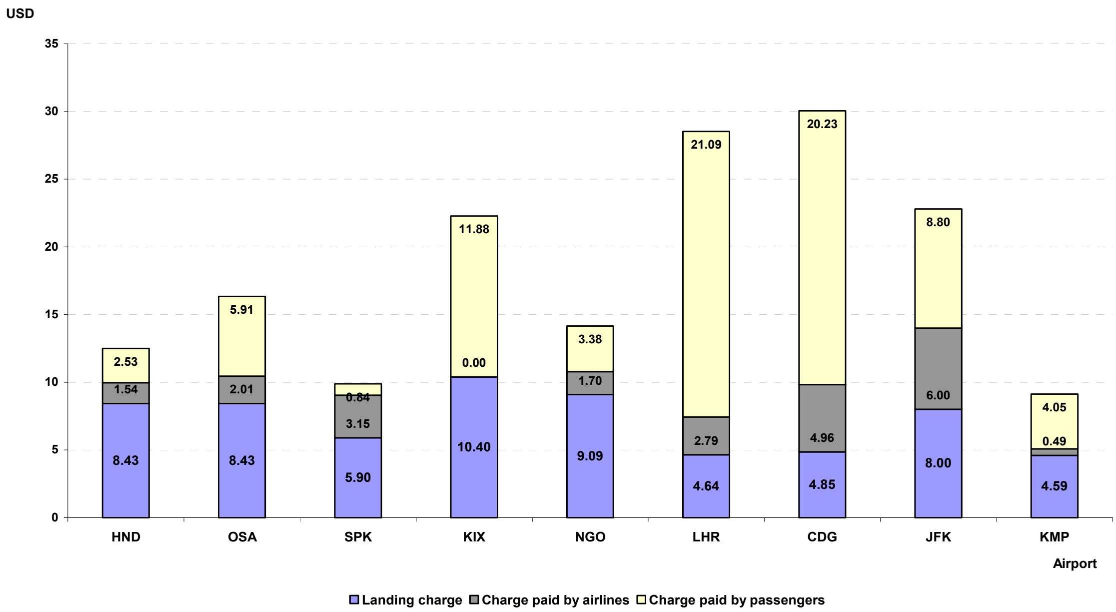
Type of aircraft	MTOW (ton)	L/D charge(JYE)	En-route navigation charge(TYO-FUK) per sector
B-737-500	53	61,600	88,510
B-747-SR100	273	324,275	455,910
B-747-400	273	317,135	455,910
B-767-200	127	144,095	2120,90
B-777-200	203	235,200	384,100
DC9-81	64	229,145	106,880
DC10-40	202	74,760	337,340
Airbus A300 B2K	137	237,510	228,790
Airbus A320-200	67	77,700	123,580
DHC-8-400	25	9,989	41,750
DHC-6-300	6	700	720

Source: Ministry of Infrastructure, Land and Transport (2005)

Note: The exchange rate, 1UD = JYE 107 in 2005

Figure 9.12 shows airport charges per passenger on domestic routes for selected airports in the world. It can be seen that the proportion of passenger charges for Japanese airports is clearly lower than those of others. It is higher for international flights. Particularly, the landing charges are expensive at Japanese airports, which are 1.5 to 7 times higher than those of other airports. The total airport charges including passengers charges at other Asian main hub airports are very low. The main international hub airports in Japan face competition from these Asian hub airports, which are 1,000-5,000 km away from Japan (see Figure 9.13).

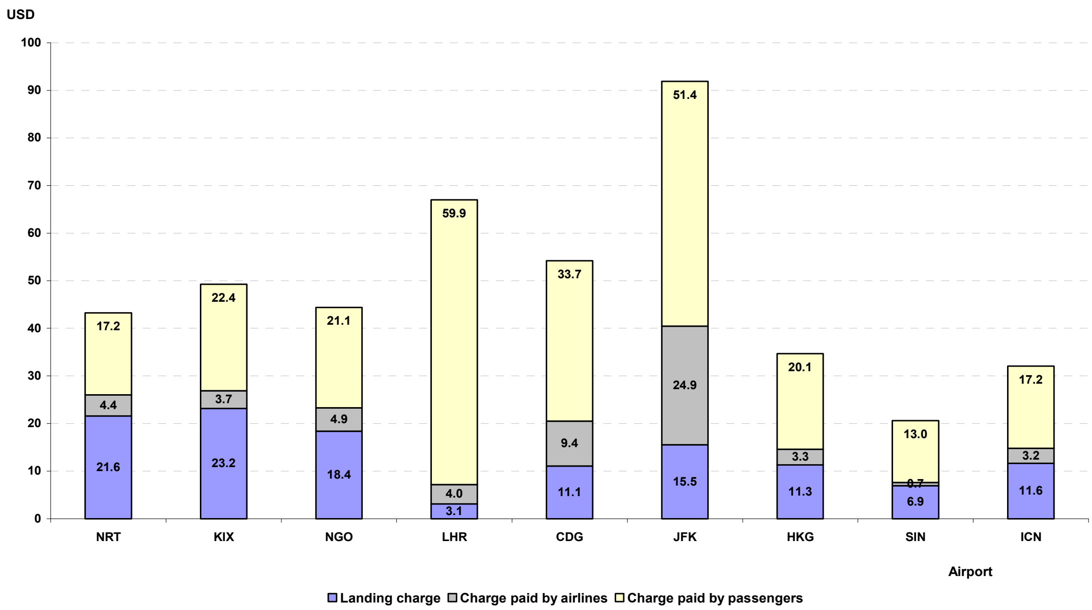
Figure 9.12: Airport charges per passenger on a typical domestic flight (USD)



Source: MILT, Ministry of Infrastructure, Land and Transport (2006)

Note: Calculations for a B-767-300 (MTOW 131t, 288 seats, 70% load factor and 1 hour parking time) by MILT based on the IATA airport and air navigation charges manual (2006)

Figure 9.13: Airport charges per passenger on a typical international flight (USD)



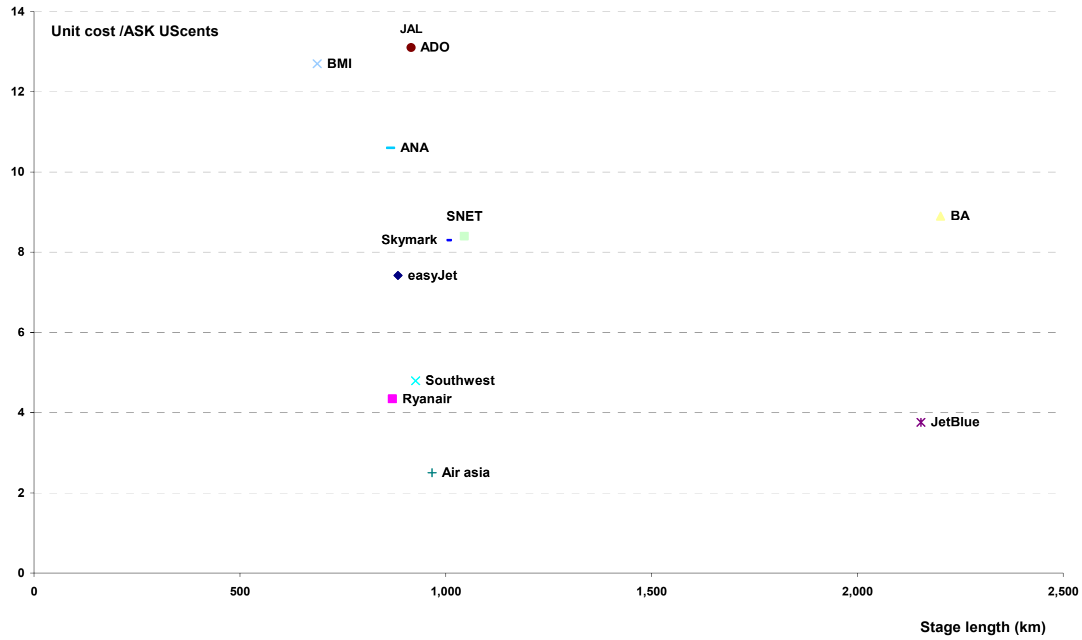
Source: MITL, Ministry of Infrastructure, Land and Transport (2006)

Note: Calculations for a B-747-400 (MTOW 395t, 430 seats, 70% load factor and 3 hours parking time) by MILT based on the IATA airport and air navigation charges manual (2006)

Japanese airlines are mainly operating large aircraft, resulting in higher aeronautical charges compared to small-sized aircraft. The difference is especially marked when comparing landing charges with international hub airports in other regions. These costs are directly reflected in fares.

Figure 9.14 contrasts the difference in unit costs (US cents) of airlines in 2004.

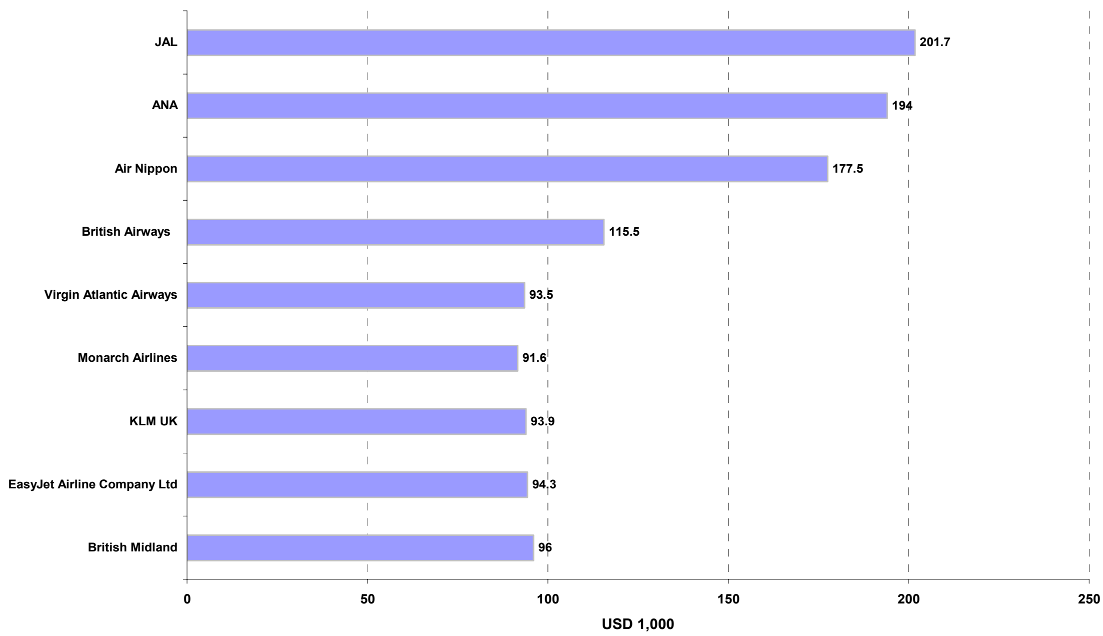
Figure 9.14: Comparison of Unit cost per ASK (US cents) in 2004



Source: Author based on data from UK CAA (2004), MILT (2004) and annual reports of airlines

The unit costs of new entrants in Japan are around 8.3 US cents per ASK compared to 13 cents for JAL and 10.6 cents for ANA. In Europe, Ryanair's unit costs are 4.3 cents per ASK compared to 7.4 US cents for easyJet and 8.9 US cents for British Airways. AirAsia's costs are only 2.5 US cents per ASK based on low capital investment and very low labour costs. The labour costs of Japanese airlines are extremely high; Figures 9.15 and 9.16 show the crew costs of selected airlines in 2000. Average annual expenditure per cockpit crew of Japan Airlines in 2000 was USD 201,700. It was reduced from the 1996 level of USD 270,000. Moreover, the cabin crew costs of Japan Airlines are very high, which rose to USD 79,400 per head in 2000. The total costs of flight crew and cabin crew of Japan Airlines accounted for more than 40% of the total operating costs in 1999. These high expenditures are caused by the relatively higher seniority of Japan Airlines' cabin crew compared to other Japanese airlines, whose incomes have been raised annually and protected by strong unions. The same applies to cockpit crew. Moreover, many working conditions of JAL and ANA, such as transportation by taxi, uniform cleaning, expensive allowances and overtime charges, and fringe benefits are very different from airlines in Europe. This also helps to explain this high expenditure for flight and cabin crew, which directly affect unit costs.

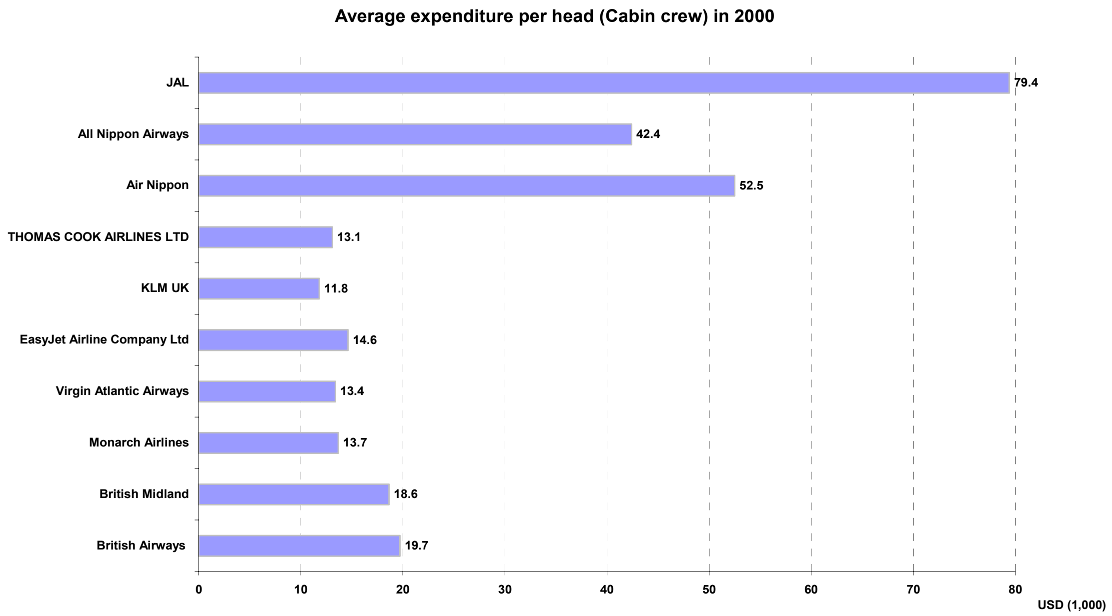
Figure 9.15: Average expenditure per cockpit crew in 2000



Source: Author based on data from UK CAA (2000) and ICAO (2000)

Average expenditure per maintenance employee of ANA was USD 69,400 in 2004, which is similar to sales and other staff of the airline. In the case of Japan Airlines, combined average expenditure per head for maintenance and other staff was USD 79,500 in 2004, which was a decrease from USD 95,000 in 2003 and USD 187,000 in 1999. Historically, the labour cost of Japan Airlines has been extremely high with its peak around 1994-1996. Since 1997, all Japanese airlines have tried to reduce labour costs but this has been very difficult for them because of strong crew unions. ANA successfully reduced the cabin crew cost to USD 42,4000 in 2000 compared to the USD 63,800 per head in 1994, by utilising parttime contract cabin crew.

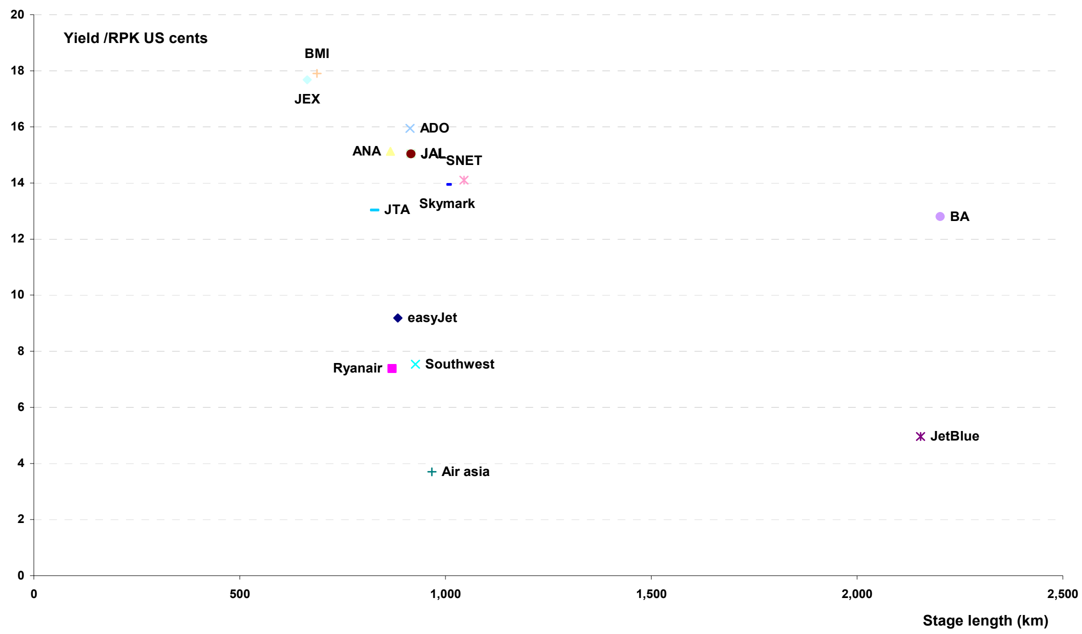
Figure 9.16: Average expenditure per cabin crew members in 2000



Source: Author based on data from UK CAA (2000) and ICAO (2000)

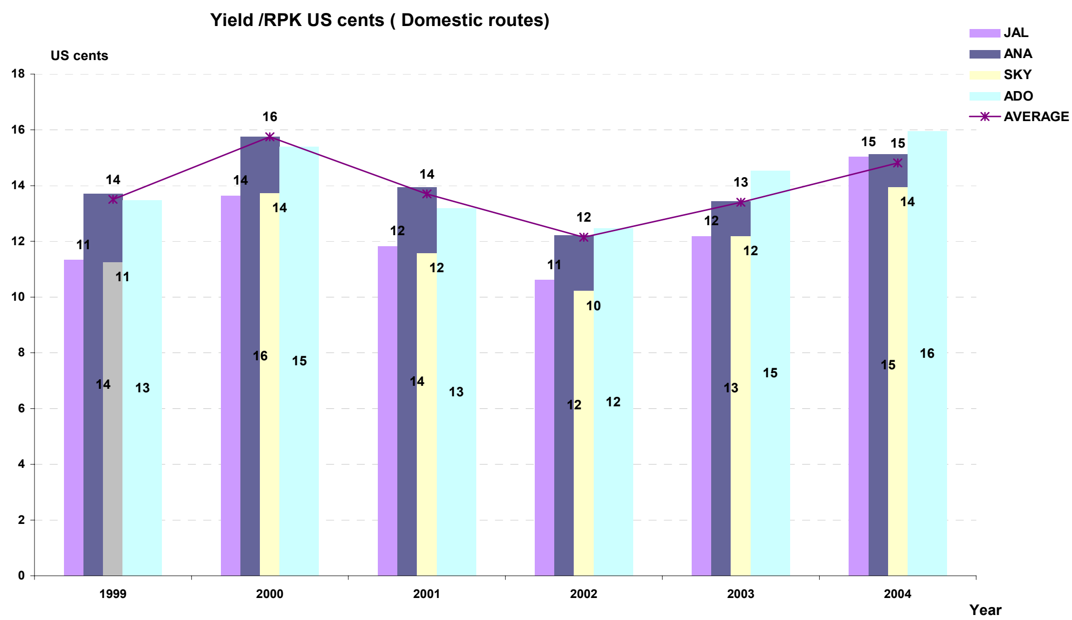
These higher costs have been covered by higher yields compared to other airlines (see Figure 9.17). Average yield per RPK of ANA and JAL in 2004 was around 15 US cents and that of Skymark 14 US cents. For selected deregulated airlines in other regions, yield per RPK varied from 5 to 9 US cents. This higher yield of Japanese airlines is especially significant on domestic routes. Figure 9.18 demonstrates the evolution of yield/RPK for Japanese airlines from 1999 to 2004. Although yields on the domestic routes were down at the beginning of deregulation (Phase I from 1997), they increased to 16 US cents in 2000. Since the second slot allocations at Haneda airport in 2000 (Phase II), average yield decreased to 12 US cents in 2002. However, it rose again to 15 US cents in 2003 when the final slot allocation of Phase II was implemented. Interestingly, yield on the domestic routes was higher after liberalisation.

Figure 9.17: Yield / RPK (US cents) by airline in 2004



Source: Author based on data from UK CAA (2004), MILT (2004) and annual reports of airlines

Figure 9.18: Yield / RPK (US cents) in the domestic market from 1999 to 2004



Source: Author based on data from Ministry of Infrastructure, Land and Transport in Japan (1999-2004)

9.4 New entrants failure in Japan

Prior to the start of the Phase I slot allocation in 1997, several new entrants were established to start operation taking advantage of the new market opportunity. Table 9.7 presents an overview of the new entrants which started their operations during the process of liberalisation in Japan. The routes and fares they have offered were analysed in chapter 6 and the results show the insignificant growth or in some cases decline on several markets, such as the Tokyo-Aomori and Tokyo-Tokushima routes as well as increased fares and unremarkable differences between the highest fares and the lowest discounted fares. The results are very different from the effects of liberalisation in other regions.

Table 9.7: Overview of new entrants in Japan

	Date of establishment	Start of operation and operation base	Main fleet and number of aircraft in 2007	Remarks
Skymark Airlines	**Nov 1996**	**Sep 1998 Tokyo**	**B-767 ER/6 B-737-800/3**	**Taken over in 2003 by Internet providing company**
Hokkaido international Airlines (Air Do)	**Nov 1996**	**Dec 1998 Sapporo**	**B-767 ER/2 B-737-400/2**	**In 2000, the airline was under the Industrial Revitalisation Cooperation Act with management support of ANA which was completed in 2005.**
JAL Express	**Apr 1997**	**July 1998 Osaka**	**B-737-400 MD-81**	**JAL's LCC subsidiary**
Skynet Asia Airways	**July 1997**	**Aug 2002 Miyazaki**	**B-737-400/8**	**In 2004, the airline was under the Industrial Revitalisation Cooperation Act with management support of ANA which was completed in 2007.**
Starflyer	**Dec 2002**	**Mar 2006 Kitakyushu**	**A320/4**	**ANA's support and cooperation**

Source: Author based on company information

In addition, all of these new entrants have been under the de facto management control of JAL and ANA. Indeed, Hokkaido International Airlines (Air Do) and Skynet Asia Airways were managed by ANA while they were under the Industrial Revitalisation Cooperation Act (cf. supra, chapter 6). Moreover, ANA and JAL had codeshare agreements with Air Do and Skymark Airlines on several routes. The most recent new entrant, Starflyer had an agreement for operational support and sales with ANA before the start of operation under Starflyer's company policy of "cooperation and co-existence" with competitors. The effects of new entrants in Japan on the market are very different from that of the EU. In this section, the reasons for this experience are investigated using Skymark as a case study.

Skymark Airlines was founded in 1996 by entrepreneur Mr. Hideo Sawada, who had established a successful travel agency in Japan, and started flight operations in 1998 offering half the fares of incumbent airlines on the Tokyo-Fukuoka route, achieving more than 80% load factors in the first year. However, load factors dropped to less than 65% in 1999 as JAL and ANA matched Skymark Airlines' fares on competing flights. The business and traffic results of Skymark are outlined in Table 9.8.

Table 9.8: Business and traffic results of Skymark Airlines from 1999 to 2005

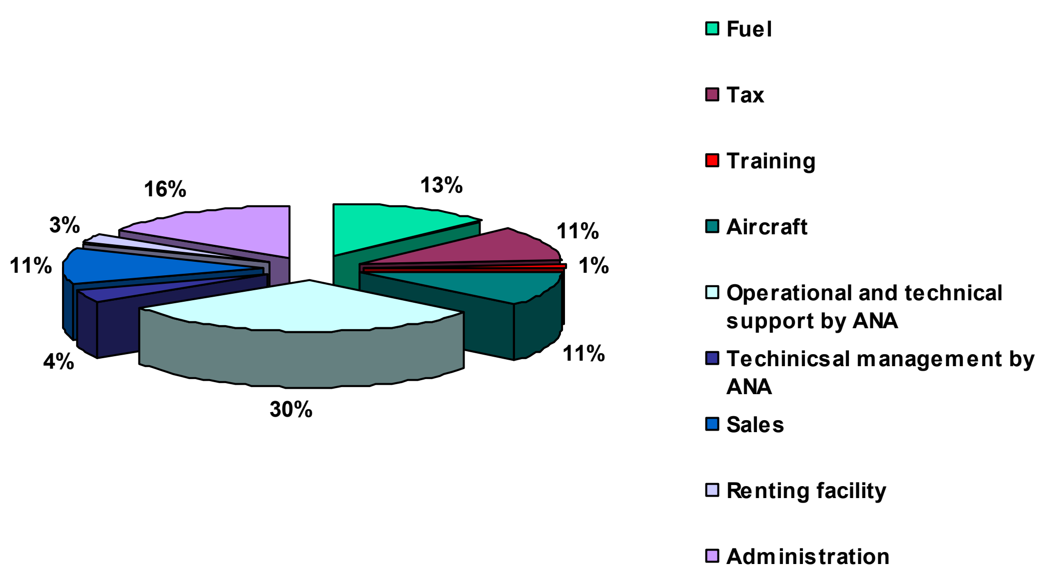
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Operating Revenues (JYE millions)	13,737	13,472	15,401	22,554	31,778	10,290	35,094
Operating Expenses (JYE millions)	16,655	14,311	16,473	22,845	30,405	12,964	37,565
Operating income (loss)(JYE millions)	-2,918	-839	-1,072	-291	1,372	64	-1,870
Net profit (loss)(JYE millions)	-3,044	-988	-1,090	-794	1,355	1,677	-701
RPK	932,255	926,988	1,127,157	1,58,714	1,790,164	1,924,380	2,222,446
ASK	1,328,238	1371274	1,703,410	2,318,848	2,901,400	3,270,530	3,972,792
Average load factor	**70%**	**68%**	**66%**	**68%**	**62%**	**59%**	**56%**
Unit cost /ASK (JYE)	**12.5**	**10.4**	**9.7**	**9.9**	**10.5**	**-**	**9.5**
Yield /RPK (JYE)	14.7	14.5	13.7	14.2	14.5	15.3	15.2
Yield /ASK (JYE)	**10.3**	**9.8**	**9.0**	**9.7**	**11.0**	**9.0**	**8.8**
Breakeven load factor	**85%**	**72%**	**71%**	**69%**	**72%**	**-**	**62%**

Source: Author based on the data of Ministry of Infrastructure, Land and Transportation and annual report (1999-2005)

Note: The fiscal year of Skymark Airlines was changed in 2004 from November–October to April-March because of the takeover of Zero company. Therefore, the financial report in 2004 was for only six months.

Table 9.8 shows their financial struggle and the decline of their business even after 9 years of operation and using 10 aircraft in 2007. Skymark had been troubled with a huge cumulative deficit since its establishment despite several capital injections from the founder's private equity capital. According to JCAB's regulation, all new entrant airlines need to have technical and operational support, such as several kinds of maintenance, training for flight crew and cabin crew, and operating manuals, provided by an incumbent airline, when they start up. Figure 9.19 shows the operating expenditure of Skymark Airlines in 2000 and highlights the expensive cost for these technical supports from ANA. It accounted for 34% of the total expenditure in this year. These costs would never be as high if new entrants could manage by themselves. However, this was a condition imposed by the Government when Skymark applied for its AOC in 1998.

Figure 9.19: Operating Expenditure of Skymark airlines in 2000



Source: Author based on company data in 2000

The sums payable to ANA proved big financial and operational obstacles for Skymark. For example, as Skymark needed to use ANA's maintenance staff in the beginning of its operations, sometimes the departures of Skymark were delayed because of lack of manpower at ANA. [38]

Although new entrants commenced their operations under the policy of promotion of competition resulting from the Phase I slot allocation system, they had to source technical support from competitors (incumbent airlines) and pay huge outsourcing costs to them. Air Do also bought technical support from JAL according to the regulations. The rationale for these regulations was that the JCAB feared many kinds of problems and wanted to prevent any safety issues, in order to avoid any concerns about the new entrants from the travelling public.[39] In addition, this policy was derived from the fundamental Government policy continued in the 45 and 47 systems in 1970, which requested incumbent airlines to support Toa Domestic Airlines when they started. Thus, competition was not fully introduced even though it was considered as the start of liberalisation.

In 2004, when Skymark Airlines was merged with Zero, a Japanese internet providing company, their capital crisis was resolved for a while. However, average load factors never reached the breakeven level even though they tried to significantly decrease costs. The operating loss and net loss resulted in financial problems for them once again. There are mainly three reasons for Skymark's unstable management: (1) Route strategy (2) Human resources, and (3) Fleet.

(1) **Route strategy**: as analysed in chapter 6, Skymark focused on the Tokyo-Fukuoka route and added frequency despite the market saturation. They opened routes from Osaka to Sapporo and Fukuoka in 1999, closing them after only one year. They also opened Tokyo-Aomori and Tokyo-Tokushima routes in 2003 instead of ANA by leasing ANA's aircraft (one B-767) and stopped services on these routes in 2004, then switched to the Tokyo-Kansai route codesharing with JAL. Although they opened several routes, they could not continue operations

[38] ANA officially mentioned this reason for the delay, however, it was also considered as a kind of competitive strategy which delayed Skymark's departures. Later, Skymark set up their own maintenance and ground handling operation.

[39] They were the first new entrants in 32 years since Kokunai Airlines was established in 1964.

until they achieved favourable results. Indeed, opening new routes is expensive and takes time in Japan because airlines are subject to strict investigations and require certification by JCAB every time. Therefore, new entrants need to carefully consider when entering new markets. However, Skymark has not always done so and their route strategy has never been stable. These actions resulted in a rising deficit.

(2) **Human resources**: The people side of Skymark has not been stable either. The average age of employees in 2003 was relatively young compared to other Japanese airlines: 32 years old. In order to reduce labour costs, non-Japanese flight crew, in-house trained co-pilots and retired flight crew were adopted, which resulted in more than 50% cost reduction compared with ANA and JAL. Part- time contract cabin crew achieved more flight hours per day at lower salary compared to other airlines and cabin cleaning formed part of their duty. However, the average service period per Skymark employee was only 2 years in 2003. Moreover, in 2005 many flight crew and maintenance staff retired at once because of a considerable amount of friction with management. As a result, operational problems arose.

(3) **Fleet:** Not only human resources but also aircraft have not been managed efficiently. In 2003, a significant maintenance problem occurred when several cracks were found in aircraft structures, leading to the cancellation of a total of 115 flights, resulting in more than USD 1.7 million loss. Several delays in aircraft delivery required new routes to be postponed (e.g. in 2004, two months delay on Tokyo-Okinawa). In 2006, a fundamental maintenance problem, which had been left for 9 months without any action, was revealed by a whistleblower. This triggered a conduct warning by the Government authority. This problem was debated at Congress and the CEO and vice chairman of Skymark were summoned to attend and explain Skymark's maintenance problems and countermeasures taken. These continuous fundamental maintenance problems directly affected traffic results and it became extremely difficult to attract demand and increase load factors even though Skymark made efforts to decrease costs and breakeven load factor.

Although Skymark Airlines has been struggling very much since they commenced operation in 1998, yield in the Japanese market is quite high compared to other regions (see Figure 9.20). While Skymark had enough opportunity to use allocated slots at Haneda airport, they could not utilise them effectively by managing their capital resources, human resources and aircraft. If they could have managed and utilised these resources and slots, and did not have to pay huge sums for contracting technical and operational support from competing incumbent airlines, they could have had more chance of success in the domestic market where average yield/RPK was 14 US cents in 2004.

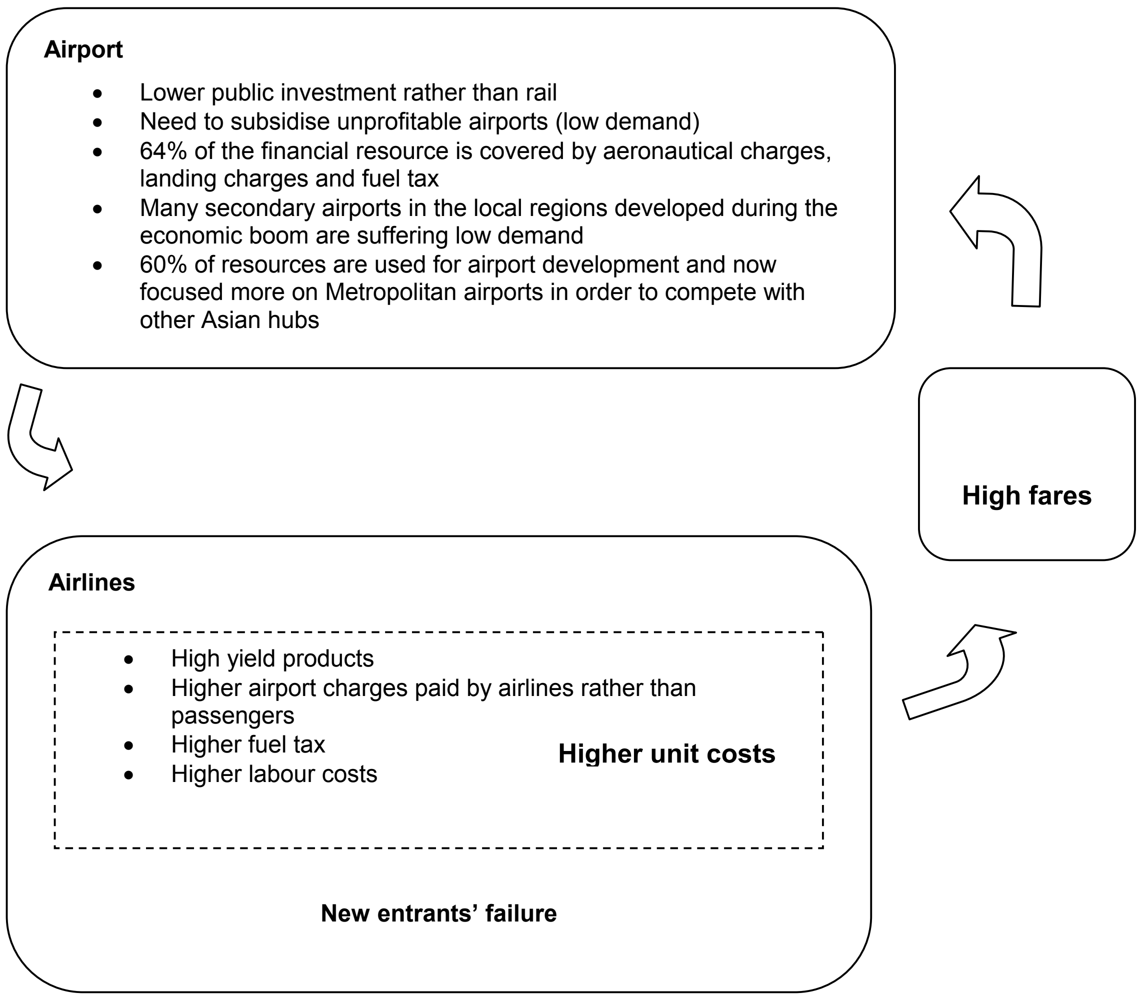
9.5 Summary

Key elements of high yield products in Japan which result in increased costs and fares were discussed in this chapter. High operating costs are caused by excessive fuel taxes and by high airport charges, which subsidise airport development, but also result from the use of large aircraftand by Japanese high yield products and high labour costs compared to airlines in the EU also increase operating costs. Thus, airlines need higher yields to compete with other airlines on the international routes.

In addition, new entrants have not been able to effectively utilise opportunities and resources including capital, aircraft, labour resources and slots. Most of them are now operating under the de facto management control of ANA in the name of cooperation. This has resulted in increased fares even after liberalisation, especially on the low demand routes. High fares cause market stagnation as a result, particularly on the low demand routes involving many category 4 and 5 airports in the local regions, which were developed based on overly ambitious economic boom estimations. The airports' financial resources are used to subsidise all airports in Japan, with a significant 64% covered by aeronautical charges paid by airlines, which directly affects costs and fares. These elements are linked with each other and cause the negative circulation in Japan, resulting in constraints for liberalisation (see Figure 9.20).

The deregulation process started in 1986 to promote competition between airlines. The process of liberalisation began in 1996 and was completed in 2000 along with the slot allocation system at Haneda airport. However, in this chapter, it was demonstrated that the market has not been fully liberalised yet because of constraints, which are demonstrated as elements of negative circulation in the domestic market in Japan.

Figure 9.20: Negative circulation of the Tokyo routes market caused by constraints



Chapter 10: Conclusions and recommendations

This chapter aims to summarise the thesis conclusions and provide recommendations for future policy. In addition, recommendations for further academic research are provided along with the contributions and limitations of this research.

10.1 Conclusions

The core aim of this thesis is to analyse the characteristics and effects of liberalisation in the Tokyo domestic market compared to the intra-EU market in order to identify the important issues during the process of liberalisation and the constraints for further liberalisation in order to provide recommendations for future policy-making.

The domestic air transport market in Japan has been developed in line with the economy since World War II under the regulations of Government. The fundamental structure of civil aviation in Japan was established in 1970 and 1972 under the 45 and 47 aviation system when the air transport market was carved out to particular airlines by the Government. The development planning of airports was started in 1967 and was followed by the Airport development special account, which was legislated in 1970. Both these government policies aimed to establish and develop the domestic air transport network in Japan. In the 45 and 47 system, excess competition was avoided and the market was controlled by the Government in order to promote "co-prosperity" of airlines. The Airport development special account aimed to construct and develop airports by subsidising non-profitable local airports.

After the rapid economic growth through the 1970s and up to 1985, the year when the Plaza accord[40] was signed, the transition from "tight regulation" to "liberalisation" of air

[40] The Plaza Accord was an agreement signed on September 22, 1985 by 5 nations - France, West Germany, Japan, the United States and the United Kingdom. The five agreed to, amongst other things, depreciate the US dollar in relation to the Japanese yen and German Deutsche Mark by intervening in the currency markets. It was aimed at alleviating the trade deficit with Japan and the exchange rate between JYE and USD changed from 1USD =JYE 235 to 1 USD = JYE 120 in a year. The signing of the Plaza Accord was significant in that it reflected Japan's emergence as a real player in managing the international monetary system. The recessionary effects of the strengthened yen in Japan's export-dependent economy created an incentive for the expansionary monetary policies that led to the Japanese asset price bubble of the late 1980s. Therefore, it is also considered as one of reasons to cause "the lost decade in Japan" after the economic boom in 1985-1992.

transport in Japan was started and considered to be completed in 2000. Several steps were taken on the way to achieving liberalisation in 2000: (1) the promotion of competition policy in 1986-1995 eased market control through double and triple designation rules, (2) the further promotion of competition policy in 1996-1999 eased the fare setting rules, and (3) further liberalisation in 2000 enabled the freedom to set fares with advance notice and the approval rule for routes was repealed (see table 10.1).

Table 10.1: Summary of the process of liberalisation in Japan

Government policy	The slot allocation system at TYO	HND Runway extension	Airport Development Plan	Period	Number of airports Jet airports /total
			1st	1967-1970	7/56
The 47 and 47 system			2nd	1971-1975	18/70
			3rd	1976-1980	28/76
			4th	1981-1985	39/78
The promotion of competition in 1986 (1986-1995)		1st Sea side extension	5th	1986-1990	48/82
		2nd Sea side extension	6th	1991-1995	54/90
The further promotion of competition (1996-1999) Liberalisation in 2000	Phase I (1997-1999) Phase II (2000-2004) Phase III (2005-2008)	3rd Sea side extension	7th	1996-2002	57/96
		Re-extension in 2009	New Airport Development Plan	2003-	

Source: Author based on data from Ministry of Infrastructure and Transport (2005)

The thesis is concentrated on the study investigates the Tokyo domestic routes, being the major market in Japan, in order to analyse the features and effects of liberalisation along with the Slot allocations system from 1997 to 2005. The Tokyo routes market has seven significant characteristics as follows: (1) high volume of demand, (2) influence of slots is prominent, (3) different features of each route category, (4) relatively low load factors, (5) significant market seasonality with peaks occurring during a short period,

(6) competition with high speed rail is more severe compared to other regions, and (7) high fares in the market. These characteristics, which are listed below, particularly stand out when compared to intra-European routes serving the UK, including domestic services (cf. supra, chapter 7).

- The size of the Tokyo routes is larger than the largest UK routes.
- Despite this fact, these Tokyo routes are operated at lower frequency by larger aircraft.
- This can be explained by the scarcity of slots at Haneda airport and the non-existence of secondary airports serving Tokyo.
- The Tokyo routes have a strong competion high speed rail, which has already developed a large network with competition intensifying as speeds as increase.

In addition, in this comparative analysis, the growth of the intra-EU air transport market serving the UK and the substantial impact of LCCs has been apparent. Competition between airlines in these markets is more severe than in Japan. The number of airlines operating on the busiest UK domestic and UK-EU routes is typically 4 to 6 compared to 1 to 4 in Japan, including network carriers' subsidiaries. In these route pairs, the numbers of airports serving at each destination are significantly different from Japan. For example, the London airport system consists of 5 airports, which has presented great opportunities for LCCs to compete with incumbent airlines and stimulate demand.

Both Japanese and EU airlines focused on the busy category 1 markets in the early stages of deregulation. The category 1 market in the EU was developed very much by the entry of LCCs. When the category 1 market in the EU matured around the year 2000, the focus of competition shifted to the category 2 market. Subsequently, competition expanded into category 3, 4 and 5 markets in order to develop new areas and to keep increasing market share in the intra-EU market as the EU continued to grow. When the competitive intensity is stronger, airlines need to optimise their resources and maximise possibilities to survive when competing with high productivity products. By reducing costs and offering lower fares, this positive flow leads to increased demand.

During the process of liberalisation of the Japanese domestic market between 1997 and 2003, the number of slots at Haneda airport was increased five times. These slot allocations aimed to promote competition and improve consumers' convenience by the formation of a diverse air transport network developing the routes serving local regions. In the first slot allocation, 80 slots were added including 12 for new entrants and 12 for the routes serving the newly opened airports as public obligation slots. The Phase III allocation from 1997-2003 involved a total of 174 slots in four steps, including 82 for new entrants and 12 as public obligation slots. In 2004, the total number of slots for airlines at Haneda airport was 774, consisting of 364 for JAL, 316 for ANA, 34 for Skymark, 20 for Air DO, 24 for Skynet Asia and 16 reserved for Starflyer and other new entrants. In 2006, these 16 reserved slots were used by above new entrants.

The results of the analysis in chapter 6 clearly demonstrated three prominent different experiences compared to the UK domestic and UK-EU markets as a result of liberalisation: (1) decreased demand, (2) increased fares, and (3) new entrants' failures. These results of liberalisation in the Tokyo routes market were demonstrated and verified statistically using Structural Equation Modelling in chapter 8.

In chapter 9, the factors which caused the different experiences and acted as constraints in the development of the domestic air transport market even after liberalisation were investigated. This analysis revealed that the results of liberalisation in Japan have the negative direction flow, as airlines provide "high yield products" compared to the "high productivity products" of EU carriers. The high yield products in Japan require and are a result of high costs, including landing charge, aeronautical charges, fuel taxes, sourcing of services from competitors and labour costs. New entrants in Japan have not been able to seize the opportunities and make full use of their resources such as routes, aircraft, human resources, slots, etc. Thus, the Japanese domestic market has become a de facto duopoly market by JAL and ANA as a result of liberalisation even though several new entrants (Skymark, Air Do, Skynet Asia and Starflyer) are operating. All of them except Skymark are operating under the de facto management control of ANA.
These outcomes enable airlines to increase fares so maintaining high yield in the domestic market in order to cross-subsidise routes where they compete with HSR and

other airlines on international routes. Fares are increased, particularly on the low demand routes (categories 4 and 5 markets), where frequency and demand dropped significantly. Most of these routes are serving airports which were constructed during the economic boom in the 1980s. As a result of the slot allocation system at Haneda airport and liberalisation, the supply of air services has shifted and has focused on the high demand routes (categories 1 and 2). The differences between routes epitomises the economic situation in Japan, which has witnessed a gap between Tokyo and local cities in terms of economic activity, especially in the ten years after the collapse of the bubble economy in the early 1990s. Moreover, in order to subsidise these local airports and develop international hub airports (Tokyo, Narita, Kansai and Chubu) in order for these to compete with other Asian international hub airports, the financial resources for these projects are supplied by high aeronautical charges, which have affected airlines' costs and fares. Thus, this negative direction flow was caused by constraints for liberalisation in the domestic market.

10.2 Policy recommendations

Important suggestions for competition policy making can be derived from the results of the analysis.

In order to change the negative direction flow in Japan to the positive direction by removing constraining factors, the reasons why LCCs in Europe achieved such a significant impact on the market is investigated. This mechanism is analysed and compared with the results of the Tokyo routes market after liberalisation. Extensive literature is available about the product features of LCCs, which have been successfully developed during deregulation, with the deregulated market affected by those airlines' products. Barrett (2006) explained the differences between airlines which are suffering "distressed airline syndrome"[41] and "deregulated airlines", which have much higher productivities to develop the market. He explains that the high productivity is achieved by reducing cost, simplifying the product, using a single aircraft type in order to maximise pilot utilisation and maintenance productivity, reducing the aircraft

[41] Doganis (2001) illustrated the "distressed state airline syndrome", which had essential features as follows: substantial losses, over-politicisation, strong union, overstaffing, no clear development strategy, bureaucratic management and poor service quality.

turnaround time at airports and outsourcing services like passenger and baggage handling, maintenance and catering.

Figure 10.1 illustrates the difference of “the deregulated market flow” between the intra-European market and Japan, which is based on Barrett’s “deregulated airline products” concept compared with those of Japanese airlines. Interestingly, different products resulted in opposite outcomes, which affected the market in a different way. In the Tokyo routes market, airlines’ operation products and distribution systems are expensive and there are no secondary airports in Tokyo. This results in high fares which affect the market negatively, decreasing demand, frequency and load factors. This market response resulted in higher costs for airlines, which were passed on to airlines’customers through higher fares. In order to increase yield in the domestic market high yield products were provided, such as business class and premium economy class on the domestic routes, and advanced check in and reservation system using mobile phones.
The flow in the case of the Tokyo market circulates in a different direction from that of the European case (see Figures 10.2 and 10.3). In these flows, airline products and the existence of secondary airports are major differences and are expalnations to enable airlines cost reductions and low fares, which stimulate demand by a result of competition among airlines. Thease are important keys in order to improve the positive results by the further liberalisation in Japan.

Figure 10.1: Deregulated market flow and its mechanism of the intra-European market and the Tokyo route market

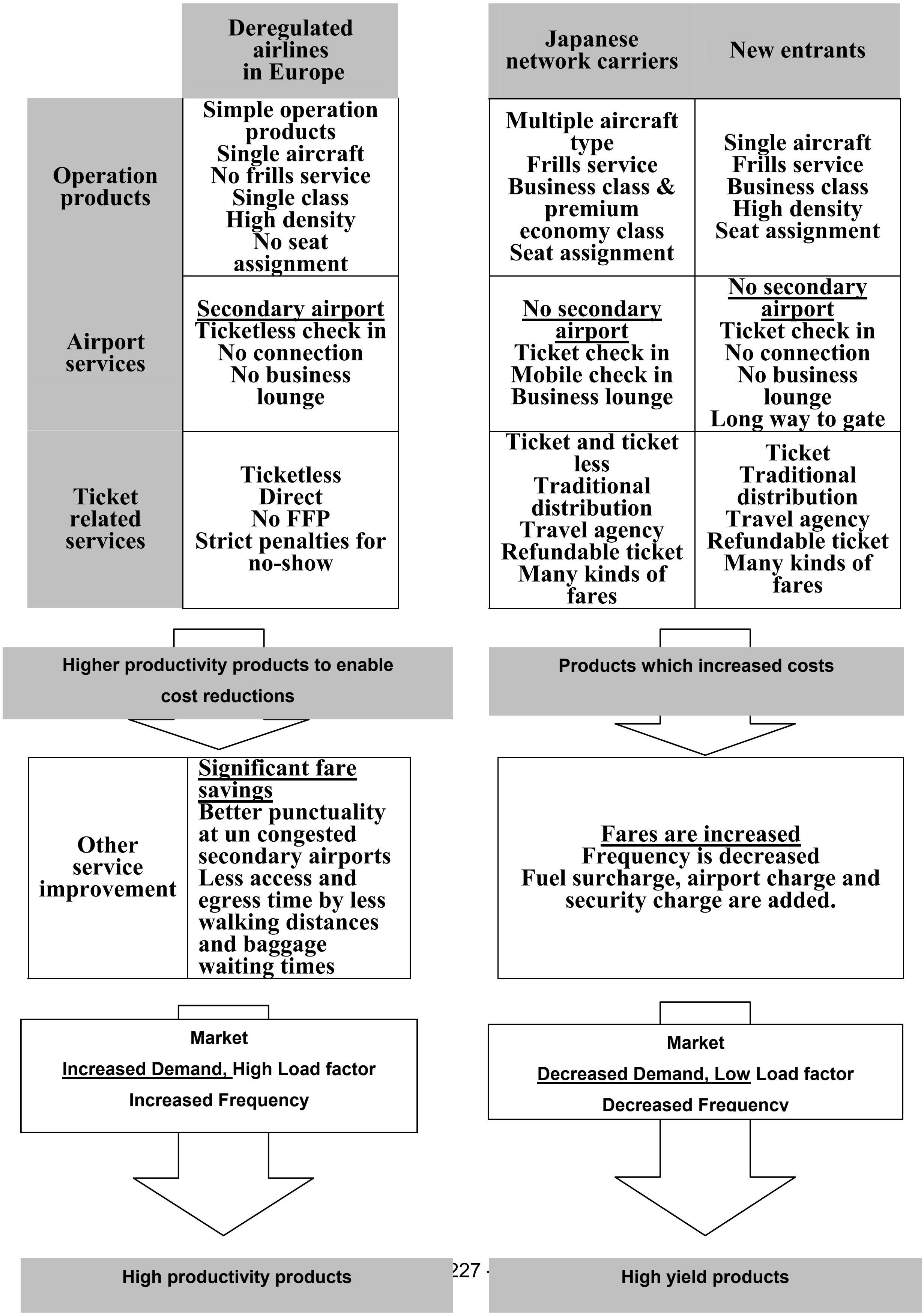
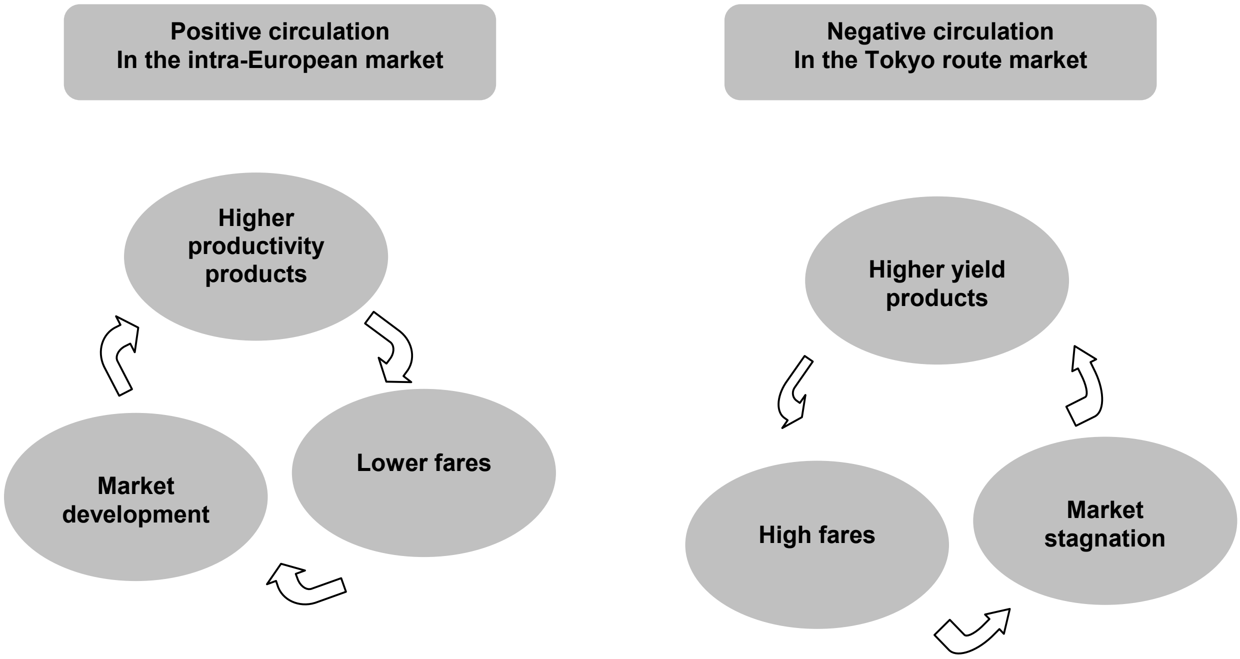


Figure 10.2: Deregulated market flow in the intra-European market (Left figure)

Figure 10.3: Market flow in the Tokyo routes market after liberalisation (Right figure)



The slot allocation policy of 2005 (Phase III) was implemented in 2006. In 2009, the number of slots at Haneda airport will be increased to 1,114 a day, which will be about 40% more than in 2005 (782 slots a day). One of the main constraints for liberalisation, which is the limitation of slots at Haneda, will thus be eased in 2009, enabling small-sized aircraft operation. However, this is not a comprehensive solution.

It is very difficult to promote a real basis for competition among airlines and HSR in Japan. Governments have been developing the transportation network of both rail and air in line with the growth of the Japanese economy under the name of competition policy since 1960s. The overestimated airport planning and demand based on the bubble economy in Japan were misestimations by the governmet.

The Japanese Government has been reluctant to implement significant changes and face the impacts of deregulation in order to avoid the bankrupted of airlines experienced in the US market. Therefore, the intensity of competition in Japanese air transport is interpreted and implemented differently from those of other areas as a result of this protective policy to Japanese airlines. The standard of competition has not reached the level of other industries like manufacturing, which have been competing in the global market. It seems that Japanese government policy has accomplished its objective which forced two network carriers (JAL and ANA) to change the structure of organisations, labour cost and their companies' hieratical cultures, although the intensity of change is not enough compared with other airlines outside Japan as a result of liberalisation.
The question is whether those Japanese airlines can compete with lower cost basis airlines in Asian countries when the air transport market is opened to others in the future. How do we need to utilise in the future the local airports which have been built and maintained with taxpayers' money in order to improve demand and economic activities in those areas?

Lower fares are crucial in order to stimulate demand and switch the direction of the market flow in Japan. To accomplish this, airlines need to offer high productivity products by reducing costs, as evidenced in the intra-EU market. The following recommendations are made in order to change the flow direction of the Japanese market to a positive circulation, with a market stimulated more by real competition between airlines and HSR.

(1) Fare setting rule

Following liberalisation in 2000 airlines can freely set fares. However, the regulation still requires advance notice in order to avoid excess competition. Moreover, flight schedules are determined at meetings of airlines, which are held every two months. Essentially, fares are fixed and announced in public by airlines two months before flight departure as a result of this regulation and customs among airlines. Although low discount fares are available they are very limited. Both airlines and HSR have not exercised yield management of their products on the domestic market in Japan (unlike in the intra-EU market) because they prefer to keep high yield and this situation is maintained by the so-called "Huddling culture" among them, which has been a big obstacle for competition in Japan. The full abolition of this fare setting rule would reduce these constraints and stimulate competition.

(2) Airports

- Secondary airports are needed which would be able to offer flexible landing and aeronautical charges to airlines in Metropolitan areas of Tokyo, Nagoya and Osaka.
- The Ministry of Land, Infrastructure and Transport has the responsibility and power to set the landing charges at airports in Japan. Therefore, they need to implement the flexible landing charge and incentives in order to simulate demand. Specifically, landing charges should be set or incentives should be provided to airlines according to demand on the routes. A range of charging brackets, varing according to demand will allow for lower fares on the low demand routes such as categories 4 and 5 as long as there is only one airport in Tokyo.
- For real competition to happen, the structure of the airport development special account should be fundamentally reconsidered in order to provide flexible management at each airport management body. It also requires an airport system where profitable airports are able to subsidise non-profitable airports, with its own financial resource rather than a single common financial resource by Government. This would provide more focus on non-aeronautical revenues at airports enabling them to develop and manage airports, by themselves. Soeda (2001) suggested this as one requirement for airport privatisation in Japan.
- The need to best utilise the capacity at Haneda airport has promoted the high-demand and profitable routes, not only domestic sectors but also scheduled international routes.[42] It is expected that from 2009 many more

[42] A new policy concerned with the usage of Haneda airport was adopted in Cabinet on 25th June, 2002 that several scheduled international flights will be operated at Haneda airport after the completion of the improvement project in 2009.

airlines will focus on profitable medium range international routes rather than non-profitable domestic categories 4 and 5 routes. This will increase the gap between Tokyo and local cities in terms of economic activity as a result. The 2009 slot allocation exercise should take these negative effects into consideration in order to promote demand on the routes serving categories 4 and 5 destinations until secondary airports in Tokyo are established.

- It should be reconsidered whether or not to continue the operation of several very low demand secondary airports in categories 4 and 5 markets. The result of the analysis demonstrates their economic and demographic scales are too small to maintain two or three airports, especially when compared with the intra-EU case and it places a big burden on the local economy. If they depend on only domestic routes, it is very doubtful that it will be possible to keep all these airports open for local economic activities.

(3) Labour cost reduction

- It is a fundamental requirement for Japanese airlines to reduce labour costs, especially the costs of flight and cabin crew. JAL already aims to reduce these costs as part of their restructuring project from 2007. Since the yield in the domestic market started dropping in 1993, both JAL (JAS) and ANA have tried to solve these problems, which are partly due to strong unions and bureaucratic cultures. This solution is essential for survival in the competitive liberalised market with competition not only from Japanese airlines, but also from other Asian airlines.
- The requirements imposed on non-Japanese flight crew should be reasonably eased in order to promote the number of qualified low cost flight crew. The current requirement is relatively strict in terms of flight hours and the medical requirement. However, it is the biggest alternative possibility to enable cost reductions. Further specific work of Government is necessary regarding this matter.

(4) Strong new entrants

- The results of this study demonstrated the insignificant impact of new entrants on the market and their failure in Japan compared to new entrants in the EU. If they could have managed their projects as independent airlines, they would have had more possibilities to succeed in the high yield domestic market. Most of them are operating as de facto subsidiary LCCs of Japanese network carriers. Despite this, there was some impact on network carriers and the airline industry as a whole, although it was not as strong as in the EU. However, strong and steady LCCs are a prerequisite for real liberalisation.
- The system for acquiring an AOC in Japan has been established since Skymark Airlines applied in 1997. Although strict safety regulations are required for a Japanese AOC, the financial fitness requirement is not as strict as that for obtaining a UK AOC. The UK regulations require monitoring of the financial fitness investigations by the authorities for three years after the initial operation. In case of unsatisfactory results, a new entrant could ultimately be forced to cease its operation. No Japanese new entrant would have satisfied this regulation. Thus, the strict financial fitness requirement is important to produce stable new entrants.
- Not only changes of the AOC system, but also the wider business environment are required for producing strong new entrants, such as a low cost maintenance company and flight crew and cabin crew training facilities certified by the JCAB. It was demonstrated in chapter 9 that the outsourcing cost of Skymark Airlines proved a big burden for the airline.
- Experienced professionals for start-up airlines: Most of the new entrants' staff consist of former JAL, JAS and ANA employees. Their sometimes strong loyalty to former companies often causes frictions among employees and means that in some cases confidential information has been leaked to competitors. Moreover, new entrants have adopted the same strategies and organisational structures as incumbent airlines. As a result, they have not been able to reinvent practices, because business customs, operational methods, marketing and distribution, etc were

adopted from the incumbent airlines. By contrast, experienced international managers in the organisation could break through this kind of solid traditional Japanese cooperative culture, examples of which are found in the manufacturing industry such as Nissan and Sony, in order to implement innovation.

10.3 Originality and contribution to knowledge

This research analyses the Tokyo domestic routes in order to identify their key characteristics and the main factors that have influenced the situation pre-and post-deregulation. The key aim of this study is to demonstrate the different experiences in the Japanese domestic market compared to those of other regions as a result of liberalisation and to identify the constraints for air transport liberalisation in Japan. Although academic literature has analysed the effects of air transport liberalisation, previous researchers have not compared the Japanese domestic market to the intra-EU market. In Japanese literature (Chujyo, 2001, Endo, 2001 and Shiomi, 2001) the positive effects of liberalisation were highlighted by analysing long term periods from 1985 to 2000 to compare the situations in 1985 and 2000.

This research attempts to investigate the changes in the domestic market in Japan by considering the key factors influencing the market change, namely: demand, supply, market share and airlines' productivity, and by focusing on the differences pre-and post-liberalisation in 2000. In addition, the relationship between these factors is analysed by identifying the key elements affecting the air transport market, such as Government policy, the airlines' reactions and the economic activity in Japan since the 1950s. In this way, the characteristics of the Japanese market are described and the reasons for the different experiences compared to the intra-EU market are explained, so as to identify the constraints for liberalisation.

This comprehensive study about the Japanese domestic market which covers extensive data is the first of its kind in literature. The main contribution of this study is the demonstration of the results of liberalisation in the domestic market in Japan using both qualitative and quantitative techniques and the provision of an analytical approach to explain the constraints for liberalisation. Moreover, this research is considered original because the results of air transport liberalisation in Japan are verified and confirmed by Structural Equation Analysis, demonstrating the importance of each factor which affects the market.

The specific contributions are as follows:

a. An analysis of the effects of air transport liberalisation in Japan using extensive types of data over a long time period, which has never before been undertaken.
b. The different experiences in Japan compared to the EU are analysed and important issues regarding the process of deregulation are identified in order to contribute to future policy making.
c. Structural Equation Modeling analysis of the air transport market has never before been undertaken. This modeling analysis seeks to verify the total effects of deregulation on the market to provide an evaluation of the importance of each key determinant and to test the overall fit of the model to the data, in the process demonstrating the structure of the deregulated air transport market in Japan.

10.4 Limitations of the research and suggestions for further research

In spite of every effort to pursue the objectives of this research, there are some limitations of this study.

The study is focused on the Tokyo routes market in order to reveal the effects of slot allocation at Haneda airport as one of the key factors affecting the market during the process of liberalisation. Therefore, there are some limitations with respect to the effects of liberalisation on the whole domestic market, especially with regards to other routes serving other congested airports such as Osaka, Nagoya and Fukuoka. Research investigating the impact on these markets serving other congested airports and the relationship between them could demonstrate clearly the effects of liberalisation on the routes serving local regions.

Competition between air transport and HSR has been analysed mainly using 2003 and 2005 data because of the limitations of Japanese HSR fare data. The results demonstrate that the high fares affect the Japanese market more than discounted fares. Further study which covers longer periods before and after liberalisation (e.g. from 1996 to 2007) could identify any change of high yield products of both airlines and HSR.

Comparative analysis with the HSR in France was adopted in order to show the LCCs impact and reaction on those routes. It revealed the differences in competition between the Japanese and French domestic markets. However, it has certain limitations compared with the Tokyo routes market in respect of demographics and economic scale. The study about the shorter sectors like Eurostar and their products and the effects on the air transport market could cover the gap caused by this limitation and demonstrate the differences between HSR in Japan and Europe more clearly.

The results of this study reveal the key elements affecting high cost products in Japan which are constraints for liberalisation. The airport system is particulary pointed out as one of the biggest constraints. The reasons and effects of the airport system on the high yield products of Japanese airlines have been analysed using existing data and literature. However, it was considered outside the scope of this thesis to discuss and demonstrate specific solutions regarding the airport issues, such as privatisation of airports in Japan and financial resourcing. A further study is needed to provide specific solutions for policy making.

This research analyses the Tokyo routes market by focusing on the period from 1997 to 2005 (Phase I to II). Phase III slot allocation was executed in 2006 based on the results of the Phase II allocation. Phase III slot allocation already impacts on the market clearly, particularly in the categories 4 and 5 markets. Airlines including new entrants have shifted their flights to more profitable routes. For example, JAL announced they were dropping a total of 11 unprofitable routes in January 2007. Low demand airports and local governments have been nervously following airlines' network changes. JAL introduced a discount ticket on the Tokyo-Nankishirahama route (category 5) following the strong request of local government in order to promote demand using subsidies from the local government account. JAL provides the new discount ticket on this route as a trial only for three months from March to June 2007. The gap among routes is expected to be larger as a result of the Phase III allocation. A further study covering the period 2003-2009 could provide clear evidence and suggestions for the 2009 slot allocation by demonstrating the results of the Phase III slot allocation.

Several local airports increased demand on international charter routes. The Noto-Taipei route increased the number of departures per year to 109 in 2005 from only 4 in 2003 and 39 in 2004. More than 20,000 passengers were carried on the route over a period of three years. The restrictions of the international charter flights were widely eased in May 2007 under the government policy to promote international demand from outside Japan and to encourage the tourism industry and air transport in Japan. The analysis of the international charter and scheduled markets serving local airports in Japan could suggest possibilities to utilise and revitalise the airports and local regions and ease the constraints for liberalisation.

The open skies agreement between the EU and the US has been concluded and will be implemented in March 2008. In Japan, the possibility of open skies with other countries has been discussed in Government since the Abe administration started in 2007. It is expected that the waves of open skies are going to reach the market in Japan much quicker than Japanese airlines and the Government expect, although they are not ready yet as a result of the imperfect domestic market liberalisation. However, a real basis for competition in the domestic market is expected when the number of slots is increased at Haneda airport in 2009. Moreover, further severe competition is waiting for Japanese airlines as they face rival Asian airports and airlines which possess extremely low cost products on a global scale. In order to prepare for the next step of liberalisation and the competition which is expected to enter the Japanese air transport market, a fundamental change and innovation of liberalised Japanese air transport system is needed by drastically removing constraints. The ultimate results will be that the air transport system in Japan will change itself.

"The wave is coming soon to Asia and Japan, whether we want it or not. We can't wait for it to happen without any preparation. We need to be ready to change ourselves."[43]
(ANA CEO Mr. Mineo Yamamoto)

[43] During the interview by the Japanese press in Copenhagen about the open skies agreement between the UK and the US in May, 2007 (source: Jiji-press, 2007)

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Ministry of Infrastructure, Land and Transportation: http://toukei.mlit.go.jp/

Industrial Revitalization Corporation of Japan: http://www.ircj.co.jp/english/index.html

Central Japan Railway: http://jr-central.co.jp/eng.nsf/english/report

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Directions de l'Aviation civile (DAC) statistics:

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Appendix

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Appendix A: Variables in demand equation modelling for selected studies

Authors (year of publication)	Areas	Data period	Factors							
			Fare	Frequency	Income	Demographic	Distance	Airport	New entrant	Others
Dresner and Tretheway (1992)	**North Atlantic routes**	**1976-1981**			**X**	**X**	**X**			
Mallebiau and Hansen(1995)	**North Atlantic routes**	**1969-1989**	**X**	**X**						**The sum of annual exports and imports**
Jorge- Calderon(1997)	**Intra European international routes**	**1989**	**X**	**X**	**X**	**X**	**X**	**X**		
Nero(1998)	**Intra European city-pairs, operated by two carries**	**1993**	**X**	**X**		**X**				**Trade** **The ratio of train to flight journey time on the route**
Clougherty et al (2001)	**Canadian international routes**	**1982-1994**	**X**	**X**		**X**				
Schipper et al (2002)	**European interstate routes**	**1988-1992**	**X**	**X**	**X**	**X**	**X**	**X**		
Bhadra (2002)	**North American regions**	**1999 -2000**	**X**		**X**	**X**	**X**	**X**	**X**	**Intensity of economic activities**

Appendix B: Variables in fare equation modelling for selected studies

Authors (year of publication)	Areas	Data period	Factors							dummy	dummy
			Pax	Cost	Frequency	Income	Demographic	Distance	Others	Liberalisation	
Nero(1998)	Intra European city-pairs, operated by two carries	1993	X	X		X	X	X		XX	A neighbouring configuration
Clougherty et al (2001)	Canadian international routes	1982-1994		X					Number of carriers	XX	Dual operation
Schipper et al (2002)	European interstate routes	1988-1992	X		X						

Appendix C: Legal articles

(1) Council Regulation (EEC) No. 95/93 of January 1993, Article 6

Article 6 Airport capacity

1. At an airport where slot allocation takes place, the competent authorities shall determine the capacity available for slot allocation twice yearly in cooperation with representatives of air traffic control, customs and immigration authorities and air carriers using the airport and / or their representative organisations and the airport coordinator, according to the airport authority it shall also be consulted.

(2) Council Regulation (EEC) No. 95/93 of January 1993, Article 8

Article 8 Process of slot allocation

1. (a) A slot has been operated by an air carrier as cleared by the coordinator shall entitle that air carrier to claim the same slot in the next equivalent scheduling period.
(b) In a situation where all slot requests cannot be accommodated to the satisfaction of the air carriers concerned, preference shall be given to commercial air services and in particular to scheduled services and programmed non-scheduled services.
(c) The coordinator shall also take into account additional priority rules established by the air carrier industry and if possible additional guidelines recommended by the coordination committee allowing for local conditions, provided such guidelines respect Community law.

4. Slots may be freely exchanged between air carriers or transferred by an air carrier from one route, or type of service, to another, by mutual agreement or a result of a total or partial takeover or unilaterally. Any such exchanges or transfers shall be transparent and subject to confirmation of feasibility by the coordinator that:
(a) airport operations would not be prejudiced;
(b) limitations imposed by a Member State according to Article 9 are respected;
(c) a change of use does not fall within the scope of Article 11.

(3) Council Regulation (EEC) No. 95/93 of January 1993, Article 2

Article 2

(b) "new entrant" shall mean:
(i) an air carrier requesting slots at an airport on any day and holding or having been allocated fewer than four slots at that airport on that day, or,
(ii) an air carrier requesting slots for a non-stop service between two Community airport where at most two other air carriers operate a direct service between these airport or airport systems on that day and holding or having been allocated fewer than four slots at that airport on that day for that non-stop service.
An air carrier holding more than 3% of the total slots available on the day in question at a particular airport, or more than 2% of the total slots available on

the day in question in an airport system of which that airport forms part, shall not be considered as a new entrant at that airport.

(4) The Cabinet Meeting Resolution of 1970 in Japan

Regarding the management system for airline industries in Japan, the following policies and procedures shall be promoted with respect to the achievement of the promotion of consumers' convenience and ensure safety in accordance with the rapid development of mass air transportation.

Article 1

2. Domestic airlines

(1) The transformation to large-sized, jet airplanes' operation shall be promoted on the basis of safe operation in order to reinforce stable airline activities.

(2) It shall be promoted to establish a new airline by the merger of Japan Domestic airlines and Toa airline at the earliest opportunity. This new company shall have the technical support and capital involvement by Japan Airlines and be expected to acquire private capital. In addition, All Nippon Airways' cooperation with this company is preferable. This new airline shall operate on local routes until it acquires the permission by the Government to operate on trunk routes.

(3) Japan airlines and Japan Domestic Airlines shall discuss any issues, which might be caused by non-consolidation of these two airlines. These decisions shall be approved by the Government.

(4) Regarding the local routes with high air transport demand, double designations shall be taken on a route in order to improve further air transport service.

Moreover, route selection and airline cooperation shall be considered, in order to avoid the negative effects caused by excessive competition.

Article 2

3. International airlines

(1) Japan Airlines shall unitarily operate as a scheduled International airline as a general rule. They shall endeavour to establish the company structure, which will satisfy demand in Japan as well as avoid the negative effects of excessive competition.

(2) Japan Airlines and All Nippon Airways shall operate international charter flights to utilise surplus aircraft in order to improve the productivity among the international air transport industry in cooperation with each other.

(3) Regarding cargo airlines, effective measures shall be considered immediately for establishing an airline structure, which can satisfy rapidly growing demand for international cargo air transport. Furthermore, the cargo handling system shall be established immediately.

(5) The Notifications by the Minister of Transport on 1st July 1972

Article 1

1. *Business field*
 (1) *Japan Airlines*
 Japan Airlines shall operate on the domestic trunk routes (all flights from Sapporo, Tokyo, Osaka, Fukuoka and Naha) and the international flights. The focus shall be on international routes. Moreover, effective measures and procedures shall be considered and proposed in order to satisfy the rapidly growing air cargo transport demand.
 (2) *All Nippon Airways*
 All Nippon Airways shall invest all its business capital in domestic trunk and local routes (all routes except the trunk routes) and try to improve short-haul international charter flights in line with the business expansion. The destination of the international charter flights shall be approved only after international diplomatic affairs are considered.
 (3) *Toa Domestic Airlines*
   a. *Toa Domestic Airlines shall operate only on the local routes. Jet aircraft operation shall be approved only when its safety is assured.*
   b. *After sufficient safe operational experience on jet aircraft on local routes, jet operation on trunk routes shall be offered. The operation of three aircraft on trunk routes shall be planned for 1974.*
   c. *Regarding the jet operation, technical support shall be needed for Toa Domestic Airlines for a while. However, they shall try to reduce their dependence on other airlines and establish the operation system independently as soon as possible.*
2. *Adjustment of transport supply*
 (1) *The expansion of supply by airlines shall be approved as long as certain demand on the route is confirmed. The present standard shall be the total average load factor (about 65% on trunk routes and 70% on local routes).*
 (2) *The market share of each airline on domestic trunk routes shall be discussed and decided by airlines according to the principle policy of coexistence and co-prosperity considering the development of airlines that started later.*
 (3) *Between 1973 and 1976, the double designation on domestic local routes shall only be allowed on two routes in any one year. An airline which started earlier shall cooperate to encourage the development of another airline, which started later according to the principle of coexistence and co-prosperity.*
 (4) *Wide body jet aircraft operation on domestic trunk routes shall be approved after 1974. Exceptionally, only for the Okinawa routes shall be approved from 1972 as long as the airport capacity is available. The timing and frequencies shall be decided after discussion among airlines.*
3. *Cooperative relationship*
4. *Others*

(6) The discussion of the management structure of the airline industry in the future" (The transport policy meeting report of June, 1986

Article 4 The competition promotion policy in the domestic market in Japan

(1) In the domestic market, the discrimination between trunk routes and local routes shall be eliminated in order to promote double or triple designations according to the demand scale and airport condition on those routes.
The high-demand routes are considered as the main target routes, in order to improve the consumer's benefit. Besides, the main airports are regarded as the strategic key factors, which may function as hub airports in the domestic network, the centres of economic activities and the major gateways for international flights. Hence, the routes between these main hub airports shall be the double and triple designations routes to promote the air transport service network as long as sufficient demand is ensured.
(2) The route evaluation standards such as the demand size, etc shall be examined considering in a fair and transparent way so as to promote competition
(3) The appropriate competition among airlines shall be expected considering the differentiations between the companies scale. Especially Japan airlines needs to be treated differently because the company scale and route structures are large compare to other airlines.
(4) It is expected that airlines shall review their business planning in order to promote competitive policy. However, it is not appropriate for airlines to expand their scale beyond the airline's ability with regards to the safety operation and sustainable supply of high-quality air transport service. Hence, each airline shall attempt to develop using reasonable business planning assumptions. In this respect, it shall be considered to review its business plan according to the company policy.
(5) The small or medium scale airlines shall mainly operate on non- profitable routes such as the remote island routes. As air transport performs an important role to local citizens, those routes shall be maintained.

Appendix D: Transition of liberalisation process in Japan and the EU

Japan		Europe	
		1956	ECAC multilalteral agreement on non-scheduled operations
		1957	Europian Community consisting of six member States established by the Treaty of Rome
		1961	EC Council of Ministers exempted sea and air transport from competition rules of the Rome Treaty until a policy could be developed
		1967	ECAC multialteral agreement on scheduled service tariffs
1970	45.47 system		
		1973	UK, Denmark & Ireland join EC
		1979	EC Civil Aviation Memorandum No.1 published, which set out general objectives regarding air transport policy
		1980	EC introduce proposal to Council regarding inter-regional services
		1981	EC report on scheduled air fares within the Community published
		1982	US/ECAC Memorandum of Understanding introducing a multilateral agreement on non-intervention zones for North Atlantic tariffs. ECAC COMPAS Report on Competition in European Air Services published.
		1983	EC Inter-Regional Air Services Directive issued by Council
		1984	EC Civil Aviation Memorandum No.2 published, which adovocated the harmonisation and liberalisation of intra-European bilaterals, and the introduction of competition rules with certain exemptions. UK/ Netherlands liberal bilateral agreement signed

(table continues on next page)

Japan		Europe	
1985	45.47 system repealed		
1986	the double & triple designation rules	1986	Nouvelles Frontieres case at European Court of Justice established that rules governing competition in the Rome Treaty applied to air transport. EC introduce proposal to amend 1983 directive on inter-regional services. ECAC Memorandum of Understanding, involving representatives of several States, on capacity share and tariffs but not market entry.
		1987	EC Single European Act implemented, which makes unanimous approval of Council decisions no longer necessary, only a qualified majority. Stage 1. of liberalisation approved by Council.
		1988	Sorensen Plan discussed, which envisages the Commission gradually taking over responsibility for the Air Services Agreements of the 12 member States.
		1989	Court of Justice decision in Ahmed Saheed case, declaring null and void ipso jure agreements on tariffs applicable to scheduled routes. Stage 2 of liberalisation proposals by Commission.
		1990	Second aviation package approved by Council of Ministers.
		1991	Commission publishes its third package of liberalisation proposals
1992	first relaxation of the double & triple designation rules	1992	Council of Ministers approves third stage measures
1994	the fare setting range rules		
1996	2nd relaxation of the double & triple designation rules		
1997	the double & triple designation rules repealed		
1998			
April	transport policy council report		
Sep	Skymark Airlines operation started		
Dec	Air Do's operation started		
1999	revision of the air law 's agreement		
2000	revision of the air law 's enforcement		

Source: The Airline Industry and the Impact of Deregulation (Williams, 1994, p. 76-77) and Author.

Appendix E: Main airports in Japan

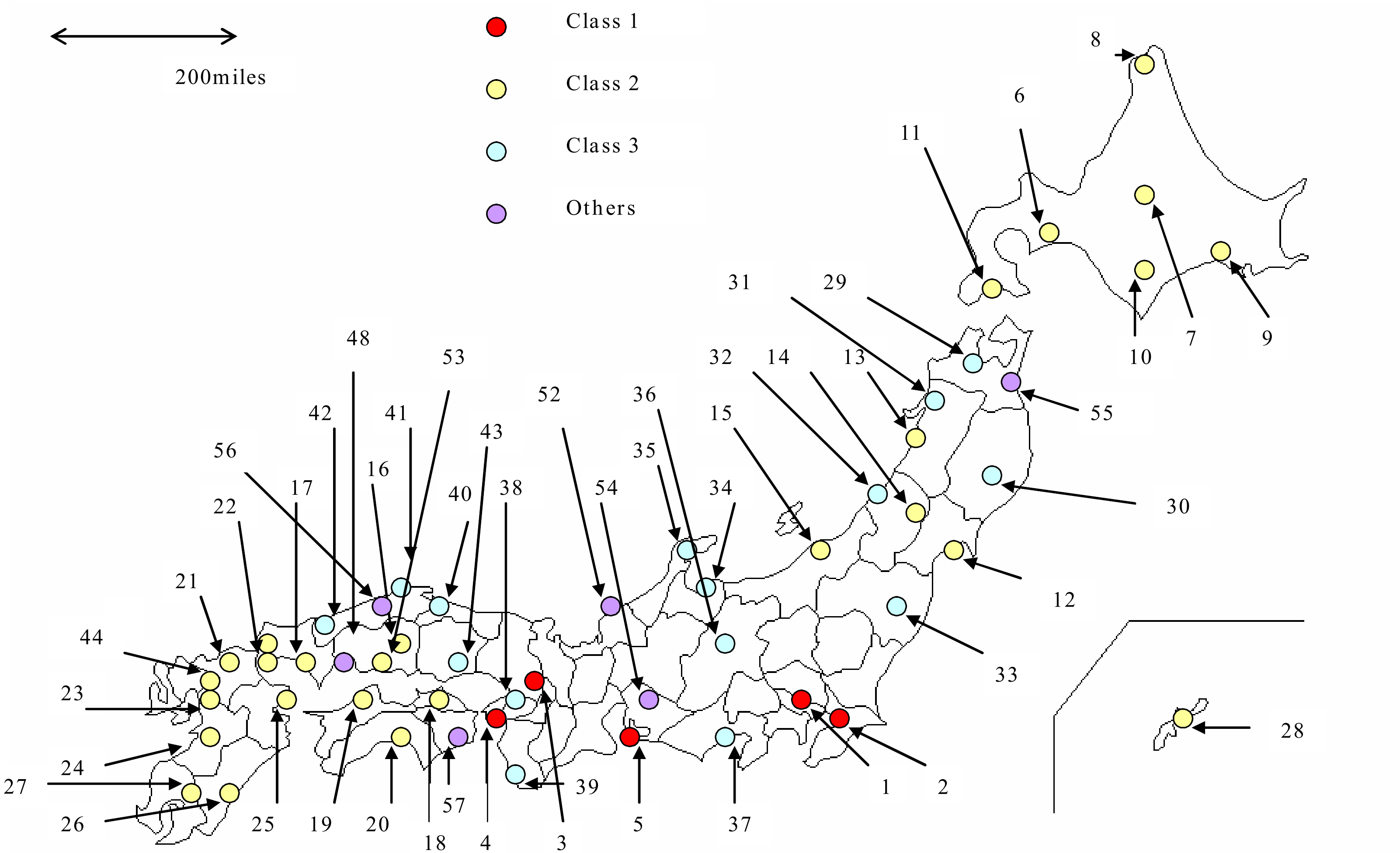
	Class	Name	Owner	Management	Code	Runway		Open date	Operation hours
1	1	Tokyo International	MLIT	MLIT	HND	A	3,000 X 60	02/07/1988	24
						B	2,500 X 60	23/03/2002	
						C	3,000 X 60	27/03/1997	
2	1	New Tokyo International	Narita International Airport corporation		NRT	A	4000 X 60	20/05/1978	6:00-23:00
						B	(2500 X 60)		
						B'	(2,180 X 60)	18/04/2002	
						C	(3,200 X 60)		
3	1	Osaka International	MLIT	MLIT	ITM	A	1,828 X 60	18/03/1958	7:00-22:00
						B	3,000 X 60	05/02/1970	
4	1	Kansai International	Kansai International Airport corporation		KIX	A	3,500 X 60	04/09/1996	24
						B	4,000 X 60	01/10/2007	
5	1	Chubu Centrea International	Central Japan International Airport company		NGO		3,500 X 60	07/02/2005	24
6	2	New Chitose(Sapporo)	MLIT	MLIT	CTS	A	3,000 X 60	20/07/1988	24
						B	3,000 X 60	26/04/1996	
7	2	Asahikawa	MLIT	Asahikawa	AKJ		2,500 X 60	01/02/1997	8:00-21:00
8	2	Wakkanai	MLIT	MLIT	WKJ		2,000 X 45	01/10/1988	8:30-20:00
9	2	Kushiro	MLIT	MLIT	KUH		2,500 X 45	30/11/2000	8:00-21:00
10	2	Obihiro	MLIT	Obihiro	OBO		2,500 X 45	21/11/1985	8:00-21:00
11	2	Hakodate	MLIT	MLIT	HKD		3,000 X 45	25/03/1999	7:30-20:30
12	2	Sendai	MLIT	MLIT	SDJ	A	1,200 X 45	01/12/1970	7:30-21:30
						B	3,000 X 45	26/03/1998	
13	2	Akita	MLIT	Akita	AXT		2,500 X 60	26/06/1982	7:30-21:30
14	2	Yamagata	MLIT	Yamagata	GAJ		2,000 X 45	01/04/1982	8:00-19:30
15	2	Niigata	MLIT	MLIT	KIJ	A	1,314 X 45	01/10/1963	7:30-8:30
						B	2,500 X 45	28/03/1996	
16	2	Hiroshima	MLIT	MLIT	HIJ		3,000 X 60	25/01/2003	7:00-21:30
17	2	Yamaguchi- Ube	MLIT	Yamaguchi	UBJ		2,500 X 45	22/03/2001	7:30-20:30
18	2	Takamatsu	MLIT	MLIT	TAK		2,500 X 60	16/12/1989	7:30-20:30
19	2	Matsuyama	MLIT	MLIT	MYJ		2,500 X 45	12/12/1991	7:30-20:30
20	2	Kochi	MLIT	MLIT	KCZ		2,000 X 45	14/12/1983	7:30-20:30
							(2,500 X 45)	01/03/2005	
21	2	Fukuoka	MLIT	MLIT	FUK		2,800 X 60	01/04/1972	(7:00-22:00)
22	2	New Kitakyushu	MLIT	MLIT	KKJ		2,500 X 60	16/03/2006	05:00-02:00
23	2	Nagasaki	MLIT	MLIT	NGS	A	1,200 X 30	01/04/1960	7:30-21:30
						B	3,000 X 60	01/04/1980	
24	2	Kumamoto	MLIT	MLIT	KMJ		3,000 X 45	01/04/1980	7:30-21:30
25	2	Oita	MLIT	MLIT	OIT		3,000 X 45	31/10/1988	7:30-21:30
26	2	Miyazaki	MLIT	MLIT	KMI		2,500 X 45	24/03/1990	7:30-21:30
27	2	Kagoshima	MLIT	MLIT	KOJ		3,000 X 45	02/10/1980	7:30-21:30
28	2	Naha	MLIT	MLIT	OKA		3,000 X 45	1972	24

(table continues on next page)

	Class	Name	Owner	Management	Code	Runway	Open date	Operation hours
29	3	Aomori	Aomori	Aomori	AOJ	2,500 X 60 (3,000 X 60)	24/03/1990 01/04/2005	7:30-21:30
30	3	Hanamaki	Iwate	Iwate	HNA	2,000 X 45 (2,500 X 45)	01/03/1983 18/03/2005	8:00-19:30
31	3	Oodate- Noshiro	Akita	Akita	ONJ	2,000 X 45	18/07/1998	8:00-19:30
32	3	Shonai	Yamagata	Yamagata	SHJ	2,000 X 45	01/10/1991	8:00-19:30
33	3	Fukushima	Fukushima	Fukushima	FKS	2,000 X 60	03/12/1998	8:30-20:00
34	3	Toyama	Toyama	Toyama	TOY	2,000 X 45	18/03/1984	7:30-20:30
35	3	Noto	Ishikawa	Ishikawa	NTQ	2,000 X 45	07/07/2003	08:00-19:30
36	3	Matsumoto	Nagano	Nagano	MMJ	2,000 X 45	26/07/1994	9:00-17:00
37	3	Shizuoka	Shizuoka	Shizuoka		(2,500 X 60)	2009	Under construction
38	3	Kobe	Kobe	Kobe	UKB	2,500 X 60	16/02/2006	07:00-22:00
39	3	Nanki-Shirahama	Wakayama	Wakayama	SHM	2,000 X 45	07/09/2000	8:30-20:00
40	3	Tottori	Tottori	Tottori	TTJ	2,000 X 45	09/07/1990	7:00-21:30
41	3	Izumo	Shimane	Shimane	IZO	2,000 X 45	07/03/1991	7:30-20:30
42	3	Iwami	Shimane	Shimane	IWJ	2,000 X 45	02/07/1993	8:00-19:30
43	3	Okayama	Okayama	Okayama	OKJ	3,000 X 45	04/10/2001	7:30-20:30
44	3	Saga	Saga	Saga	HSG	2,000X 45	1998	06:30-2100 00:30-04:30
45	3	Hachijyojima	Tokyo	Tokyo	HAC	2,000X 45	1962	08:00-18:00
46	3	Oshima	Tokyo	Tokyo	OIM	1,800 X 45	1964	08:30-16:30
47	3	Ishigaki	Okinawa	Okinawa	ISG	1,500X 45	1973	08:00-21:00
48	3	Amamioshima	Kagoshima	Kagoshima	ASJ	2,000 X 45	1988	08:00-19:30
49	3	Miyakejima	Tokyo	Tokyo	MYE	1,200 X30	1966	09:00-17:00
50	3	Miyakojima	Okinawa	Okinawa	MMY	2,000 X 45	1973	08:00-21:00
51	3	Kumejima	Okinawa	Okinawa	UEO	2,000 X 45	1973	08:00-19:30
52	3	Fukui	Fukui	Fukui	FKJ	1,200 X 30	1988	9:00-17:00
53	3	Hiroshima-nishi	Hiroshima	Hiroshima	HIW	1,800 X 45	1993	7:30-21:30
54	Others	Nagoya airfield	Aichi	Aichi	NKM	2,750 X 45	2005	7:00-21:00
55	Others	Misawa	US Air force	US Air force	MSJ	3,050 X 45	1977	8:30-20:00
56	Others	Miho(Yonago)	Defence force	Defence force	YGJ	2,000 X 45	1969	07:00-22:00
57	Others	Tokushima	Defence force	Defence force	TKS	2,000 X 45	24/04/1987	7:30-20:30

Source: Ministry of Land, Infrastructure and Transport (2006)

Appendix F: Main airports in Japan (map)



Note: Airport names corresponding to the numbers shown on the map can be found in Appendix D.

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Appendix G: Market segmentation of the Tokyo routes and key characteristics in 2000

airlines	year	routes	name	category	stage length	number of airlines	number of new entrants	number of departure(thousand) per year	number of pasengers(thousands) per year	number of supplied seats(thousands) per year	load factor	number of departure per day	number of passenger per day(thousands)
JL/NH/JS/AD	2000	spk	sapporo	1	894	4	1	31.812	8982.063	13797.692	65.1	87.2	24.608
JL/NH/JS/BC	2000	fuk	fukuoka	1	1041	4	1	28.816	7989.491	12528.628	63.8	78.9	21.889
JL/NH/JS	2000	osa	osaka	1	514	3	0	13.009	4359.858	6168.515	70.7	35.6	11.945
JL/NH/JS	2000	oka	okinawa	1	1687	3	0	13.062	3745.444	5172.126	72.4	35.8	10.261
Average					**1034**	**4**	**0.5**	**21.675**	**6269.214**	**9416.740**	**68.0**	**59.4**	**17.176**
JL/NH/JS	2000	kix	kansai	2	687	3	0	10.522	2325.985	3622.516	64.2	28.8	6.373
JL/NH/JS	2000	hij	hiroshima	2	790	3	0	9.916	2231.196	3421.100	65.2	27.2	6.113
JL/NH/JS	2000	koj	kagoshima	2	1111	3	0	9.134	2025.747	3298.450	61.4	25.0	5.550
JL/NH/JS	2000	kmq	komatsu	2	528	3	0	7.609	2021.863	2901.855	69.7	20.8	5.539
Average					**779**	**3**	**0**	**9.295**	**2151.198**	**3310.980**	**65.1**	**25.5**	**5.894**
JL/NH/JS	2000	kmj	kumamoto	3	1056	3	0	7.591	1550.937	2391.240	64.9	20.8	4.249
JL/NH	2000	hkd	hakodate	3	786	2	0	5.308	1398.429	2282.289	61.3	14.5	3.831
JL/NH/JS	2000	kmi	miyazaki	3	1023	3	0	7.633	1327.765	2397.259	55.4	20.9	3.638
JL/NH/JS	2000	ngs	nagasaki	3	1143	3	0	7.090	1507.474	2482.450	60.7	19.4	4.130
NH	2000	okj	okayama	3	685	1	0	3.272	514.014	742.381	69.2	9.0	1.408
NH/JS	2000	tak	takamatsu	3	711	2	0	5.805	1173.382	1696.476	69.2	15.9	3.215
JL/NH	2000	myj	matsuyama	3	859	2	0	6.374	1293.186	2022.223	63.9	17.5	3.543
JL/NH/JS	2000	oit	oita	3	928	3	0	7.260	1287.451	2048.200	62.9	19.9	3.527
Average					**899**	**2**	**0**	**6.292**	**1256.580**	**2007.815**	**63.4**	**17.2**	**3.443**
JL/NH	2000	axt	akita	4	555	2	0	4.727	882.392	1459.012	60.5	13.0	2.418
NH	2000	toy	toyama	4	570	1	0	4.205	872.164	1251.090	69.7	11.5	2.389
NH	2000	ubj	yamaguchiube	4	935	1	0	3.637	670.223	999.340	67.1	10.0	1.836
NH/JS	2000	tks	tokushima	4	703	2	0	5.093	807.927	1333.834	60.6	14.0	2.213
JL/NH/JS	2000	kcz	kochi	4	824	3	0	5.637	861.112	1393.842	61.8	15.4	2.359
NH/JS	2000	akj	asahikawa	4	1052	2	0	4.783	735.004	1286.226	57.1	13.1	2.014
NH/JS	2000	aoj	aomori	4	690	2	0	5.783	978.419	1502.019	65.1	15.8	2.681
NH/JS	2000	kuh	kushiro	4	1032	2	0	3.758	530.830	923.922	57.5	10.3	1.454
Average					**795**	**2**	**0**	**4.703**	**792.259**	**1268.661**	**62.4**	**12.9**	**2.171**
NH	2000	ygj	yonago	5	776	1	0	2.867	364.843	600.258	60.8	7.9	1.000
JS	2000	izo	izumo	5	801	1	0	3.078	498.303	731.433	68.1	8.4	1.365
JL/NH/JS	2000	mmb	memanbetsu	5	1156	3	0	3.078	498.760	875.741	57.0	8.4	1.366
JL/JS	2000	obo	obihiro	5	999	2	0	2.895	525.311	853.287	61.6	7.9	1.439
NH	2000	syo	shonai	5	489	1	0	2.163	366.093	536.988	68.2	5.9	1.003
NH	2000	ttj	tottori	5	667	1	0	2.188	331.490	516.600	64.2	6.0	0.908
JS	2000	kkj	kitakyushu	5	958	1	0	1.946	158.818	260.764	60.9	5.3	0.435
JS	2000	msj	misawa	5	685	1	0	2.836	430.397	763.552	56.4	7.8	1.179
JS	2000	shm	nankishirahama	5	634	1	0	1.856	142.962	256.802	55.7	5.1	0.392
ANK	2000	onj	odatenoshiro	5	628	1	0	1.248	106.702	187.650	56.9	3.4	0.292
NH	2000	hsg	saga	5	1130	1	0	1.458	166.030	280.600	59.2	4.0	0.455
NH	2000	wkj	wakkanai	5	1195	1	0	1.014	155.327	262.035	59.3	2.8	0.426
ANK	2000	shb	nakashibetsu	5	1118	1	0	1.437	109.672	219.537	50.0	3.9	0.300
NH	2000	gaj	yamagata	5	441	1	0	0.728	72.258	125.396	57.6	2.0	0.198
ANK	2000	iwj	iwami	5	907	1	0	1.447	102.083	240.107	42.5	4.0	0.280
Average					**839**	**1**	**0**	**2.016**	**268.603**	**447.383**	**58.6**	**5.5**	**0.736**
ANK	2000	hac	hachijyojima	6	353	1	0	2.859	236.040	436.762	54.0	7.8	0.647
ANK	2000	oim	oshima	6	162	1	0	2.030	90.275	129.872	69.5	5.6	0.247
JTA	2000	isg	ishigaki	6	2171	1	0	0.954	116.232	143.117	71.7	2.6	0.318
JS	2000	asj	amamioshima	6	1436	1	0	0.718	72.840	116.985	62.3	2.0	0.200
JTA	2000	mmy	miyakojima	6	2020	1	0	0.724	84.004	120.038	70.0	2.0	0.230
JTA	2000	ueo	kumejima	6	1888	1	0	0.237	25.402	35.550	71.5	0.6	0.070
Average					**1338**	**1**	**0**	**1.254**	**104.132**	**163.721**	**66.5**	**3.4**	**0.285**
Average of the whole Tokyo routes					**920**	**2**	**0**	**6**	**1216**	**1885**	**63**	**15**	**3**

Source: Author based on data from the Ministry of Land, Infrastructure and Transport, Aviation Statistics in 2000

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Appendix H: High speed rail and fares in several regions

Train	From	To	Distance (km)	Time (min)	Speed km/h	Cheapest fare local curency	Standard fare local curency	Cheapest fare USD	Standard fare USD
France									
TGV 6171	Lyon-St Exupery	Aix-en- Provence	289.6	66	263.3	19	39.5	23.0	47.8
TGV 5102	Valence TGV	Avignon TGV	129.7	30	259.4	16	19	19.4	23.0
TGV 9802	Massy TGV	St-Pierre-des- Corps	206.9	49	253.3	18	37.5	21.8	45.4
6 TGV	Paris Lyon	Avignon TGV	657	156	252.7	44	68	53.2	82.3
TGV 6109	Paris Lyon	Aix-en- Provence	730.7	176	249.1	47.5	68	57.5	82.3
7 TGV	Avignon TGV	Valence TGV	129.7	31	251.0	16	19	19.4	23.0
Japan									
Nozomi	Nagoya	Tokyo	366	104	211.2	10780	10780	91.8	91.8
Nozomi 501	Hiroshima	Kokura	192	47	245.1	7730	7730	65.8	65.8
Nozomi 1	Shin-Kobe	Okayama	143.4	38	226.4	6060	6060	51.6	51.6
8 Nozomi	Okayama	Hiroshima	161.3	42	230.4	6260	6260	53.3	53.3
17 Hayate	Sendai	Morioka	183.5	44	250.2	6490	6490	55.3	55.3
11 Hayate	Omiya	Sendai	321.5	74	260.7	5460	5460	46.5	46.5
Nozomi 1	Shin-Yokohama	Nagoya	337.2	83	243.8	10150	10150	86.5	86.5
Nozomi	Shin-Kobe	Tokyo	589.5	174	203.3	14670	14670	125.0	125.0
European									
Thalys Soleil	Brussels Midi	Valence TGV	831.7	206	242.2	75	91	90.8	110.1
Thalys 9995	Marne-la-Valtee	Brussels Midi	315.8	81	233.9	31	43	37.5	52.0
Thalys 9884	Brussels Midi	Roissy- CdG	291.7	75	233.4	31	43	37.5	52.0
51 Thalys trains	Brussels Midi	Paris Nord	313.6	85	221.4	55	55	66.6	66.6
Eurostar 9053	Marne-la-Valtee	Ashford international	403.4	114	212.3	125	125	151.3	151.3
4 Eurostar	Ashford international	Paris Nord	401.5	114	211.3	149	149	180.3	180.3

(table continues on next page)

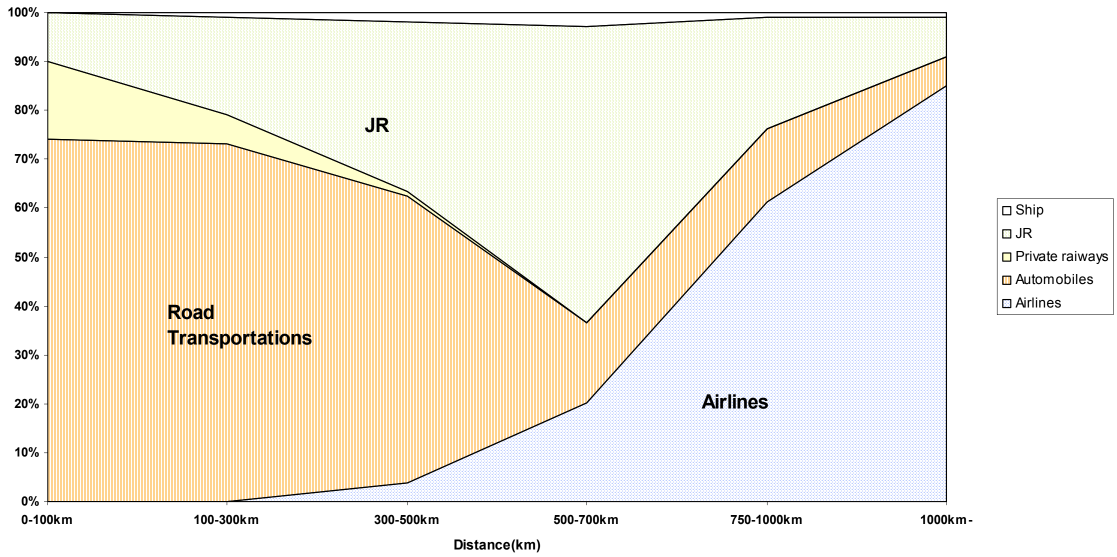
Train	From	To	Distance (km)	Time (min)	Speed km/h	Cheapest fare local curency	Standard fare local curency	Cheapest fare USD	Standard fare USD
Germany									
17 ICE trains	Frankfurt Flughafen	Siegburg/ Bonn	144	37	233.5	47	47	56.9	56.9
ICE 829	Siegburg/ Bonn	Montabaur	63	18	210.0	10	37	12.1	44.8
11 ICE trains	Frankfurt Flughafen	Limburg Sud	59	17	208.2	25	25	30.3	30.3
ICE 277	Berlin Spandau	Wolfsburg	168.9	50	202.7	39	39	47.2	47.2
ICE 11	Koln Hbf	Frankfurt Flughafen	169.3	52	195.3	53	53	64.1	64.1
ICE 924	Mondabaur	Frankfurt Flughafen	81	25	194.4	30	30	36.3	36.3
Korea									
5 KTX trains	Seoul	Daejeon	155	49	189.8	19500	19500	20.0	20.0
KTX 109	Seoul	Daegou	292	93	188.4	34900	34900	35.8	35.8
3 KTX trains	Daejeon	Daegou	137	47	174.9	15400	15400	15.8	15.8
4 KTX trains	Seol	Busan	410	154	159.7	44800	44800	45.9	45.9
United Kingdom									
1 IC 225	Stevenage	Grantham	125.3	41.5	181.2	22	29	38.1	50.3
1 IC 225	London King's Cross	Retford	222.9	75.5	177.1	34	56.5	59.0	98.0
4 trains	Doncaster	Peterborough	128.2	43.5	176.8	11	30.5	19.1	52.9
1 Pioneer	London King's Cross	Grantham	169.5	58	175.3	25	41	43.4	71.1
1 IC 225	London King's Cross	Doncaster	250.6	86	174.8	16.5	40	28.6	69.4
USA									
13 Acela Express	Wilmington	Baltimore	110.1	40	165.2	43	70	43.0	70.0
15 Acela Express	Philadelphia	Wilmington	50.6	20	151.8	23	45	23.0	45.0

Source: Author based on the European rail time table and company information

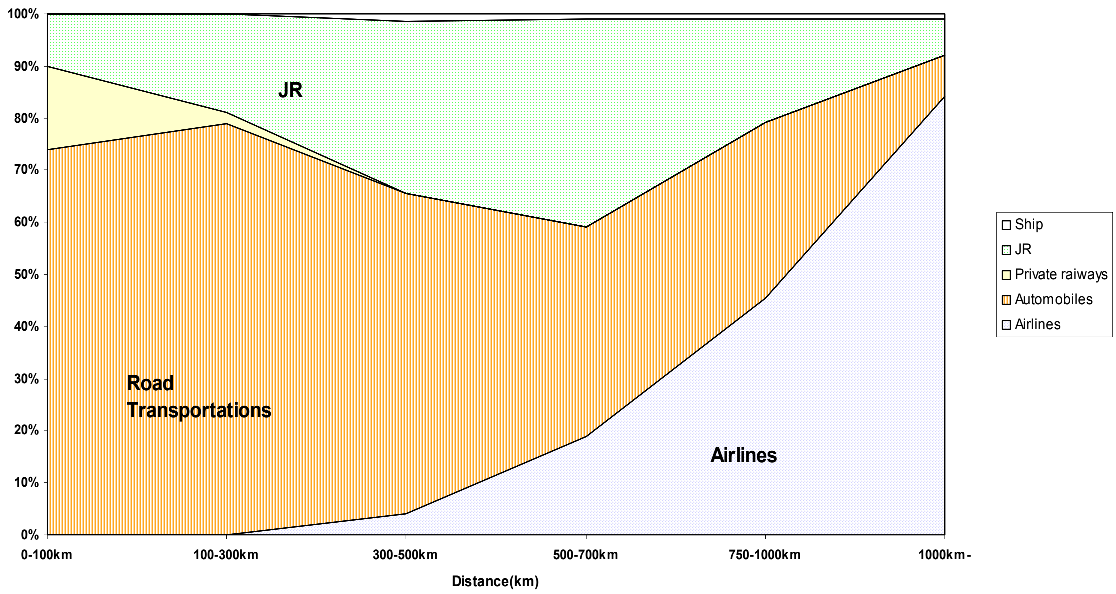
Notes: Fares are acuired from company websites in April 2006. The exchange rates adopted were the Representative Rates for Selected Currencies, as reported in the exchange rate archives of the International Monetary Fund.

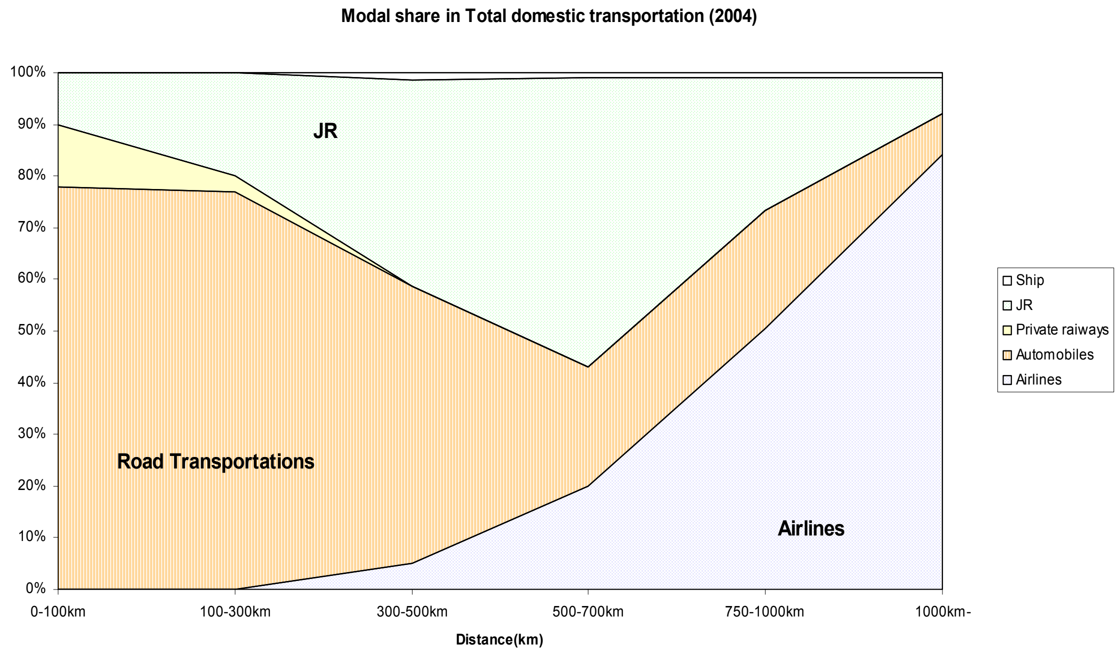
Appendix I: Modal share in the total domestic transportation in 2000, 2003 and 2004

Modal share in Total Domestic Transportation in 2001



Modal share in Total Domestic tranportation (2003)





Source: Ministry of Land, Infrastructure and Transport, Aviation statistics (2001, 2003 and 2004) and Japan Railway Central annual report (2004)

Notes: The distance is the train distance between Tokyo station and the main station of each local city. The three-letter codes are the names of airports located at each local city.

Appendix J: Matrix of factors on the Tokyo routes by category in 1997

airlines	year	routes	name	category	stage length	number of departure (000) per year	number of pasengers (000) per year	number of supplied seats (000) per year	load factor	number of departure per day	number of passenger per day (000)	number of airlines	number of passenger per flight	number of seats per flight
JL/NH/JS	1997	spk	sapporo	1	894	25.638	8127.341	11926.35	68.1	70.2	22.267	3	317.0	465.2
JL/NH/JS	1997	fuk	fukuoka	1	1041	22.750	6748.564	10090.3	66.9	62.3	18.489	3	296.6	443.5
JL/NH/JS	1997	osa	osaka	1	514	7.275	2585.034	3574.982	72.3	19.9	7.082	3	355.3	491.4
JL/NH/JS/JTA	1997	oka	okinawa	1	1687	9.414	3011.463	4209.597	71.5	25.8	8.251	4	319.9	447.2
Average					**1034**	**16.269**	**5118.101**	**7450.307**	**69.7**	**44.6**	**14.022**	**3.25**	**322.2**	**457.9**
JL/NH/JS	1997	kix	kansai	2	687	7.126	1675.813	2529.066	66.3	19.5	4.591	3	235.2	354.9
JL/NH/JS	1997	hij	hiroshima	2	790	7.466	1738.906	2507.096	69.4	20.5	4.764	3	232.9	335.8
JL/NH/JS	1997	koj	kagoshima	2	1111	7.850	1904.503	3162.585	60.2	21.5	5.218	3	242.6	402.9
JL/NH/JS	1997	kmq	komatsu	2	528	6.308	1768.561	2692.984	65.7	17.3	4.845	3	280.4	426.9
Average					**779**	**7.188**	**1771.946**	**2722.933**	**65.4**	**19.7**	**4.855**	**3**	**247.8**	**378.8**
JL/NH/JS	1997	kmj	kumamoto	3	1056	6.494	1460.076	2230.313	65.5	17.8	4.000	3	224.8	343.4
JL/NH	1997	hkd	hakodate	3	786	5.547	1146.330	2311.535	62.6	15.2	3.141	2	206.7	416.7
JL/NH/JS	1997	kmi	miyazaki	3	1023	7.021	1248.306	2089.876	59.7	19.2	3.420	3	177.8	297.7
JL/NH/JS	1997	ngs	nagasaki	3	1143	6.505	1542.253	2437.218	63.3	17.8	4.225	3	237.1	374.7
NH	1997	okj	okayama	3	685	2.889	359.017	617.904	58.1	7.9	0.984	2	124.3	213.9
NH/JS	1997	tak	takamatsu	3	711	5.398	1094.735	1646.61	66.5	14.8	2.999	2	202.8	305.0
JL/NH	1997	myj	matsuyama	3	859	5.787	1228.202	1705.271	72.0	15.9	3.365	2	212.2	294.7
JL/NH/JS	1997	oit	oita	3	928	6.554	1197.224	2010.246	59.6	18.0	3.280	3	182.7	306.7
Average					**899**	**5.774**	**1159.518**	**1881.122**	**63.4**	**15.8**	**3.177**	**2.5**	**196.0**	**325.8**

(table continues on next page)

airlines	year	routes	name	category	stage length	number of departure (000) per year	number of pasengers (000) per year	number of supplied seats (000) per year	load factor	number of departure per day	number of passenger per day (000)	number of airlines	number of passenger per flight	number of seats per flight
JL/NH	1997	axt	akita	4	555	4.338	865.260	1485.392	58.3	11.9	2.371	2	199.5	342.4
NH	1997	toy	toyama	4	570	4.303	817.219	1153.858	70.8	11.8	2.239	1	189.9	268.2
NH	1997	ubj	yamaguchiube	4	935	3.606	626.005	889.072	70.4	9.9	1.715	1	173.6	246.6
NH/JS	1997	tks	tokushima	4	703	4.609	775.408	1200.855	64.6	12.6	2.124	2	168.2	260.5
JL/NH/JS	1997	kcz	kochi	4	824	4.170	756.114	1138.074	66.4	11.4	2.072	3	181.3	272.9
NH/JS	1997	akj	asahikawa	4	1052	4.985	791.321	1315.474	60.2	13.7	2.168	2	158.7	263.9
NH/JS	1997	aoj	aomori	4	690	3.886	804.919	1118.503	72.0	10.6	2.205	2	207.1	287.8
NH/JS	1997	kuh	kushiro	4	1032	3.618	524.213	938.446	55.9	9.9	1.436	2	144.9	259.4
Average					**795**	**4.189**	**745.057**	**1154.959**	**64.8**	**11.5**	**2.041**	**1.9**	**177.9**	**275.7**
ANC	1997	ygj	yonago	5	776	2.895	323.897	468.53	69.1	7.9	0.887	1	111.9	161.8
JS	1997	izo	izumo	5	801	2.880	434.911	712.801	61.1	7.9	1.192	1	151.0	247.5
JL/NH/JS	1997	mmb	memanbetsu	5	1156	3.724	488.912	903.65	54.1	10.2	1.339	3	131.3	242.7
JL/JS	1997	obo	obihiro	5	999	3.430	488.743	838.144	58.3	9.4	1.339	2	142.5	244.4
NH	1997	syo	shonai	5	489	1.993	314.006	489.112	64.2	5.5	0.860	1	157.6	245.4
NH	1997	ttj	tottori	5	667	2.166	298.542	457.636	65.2	5.9	0.818	1	137.8	211.3
JS	1997	kkj	kitakyushu	5	958	1.421	141.049	190.414	76.1	3.9	0.386	1	99.3	134.0
JS	1997	msj	misawa	5	685	2.876	419.017	734.953	57.0	7.9	1.148	1	145.7	255.5
JS	1997	shm	nankishirahama	5	634	1.437	118.383	192.418	61.5	3.9	0.324	1	82.4	133.9
NH	1997	wkj	wakkanai	5	1195	0.903	143.766	222.052	64.7	2.5	0.394	1	159.2	245.9
ANK	1997	shb	nakashibetsu	5	1118	1.261	110.780	185.926	59.6	3.5	0.304	1	87.9	147.4
NH	1997	gaj	yamagata	5	441	1.935	252.225	393.086	64.2	5.3	0.691	1	130.3	203.1
ANK	1997	iwj	iwami	5	907	1.262	120.585	209.252	57.6	3.5	0.330	1	95.6	165.8
Average					**833**	**2.168**	**281.140**	**461.3826**	**62.5**	**5.9**	**0.770**	**1.2**	**125.6**	**212.8**
ANK	1997	hac	hachijyojima	6	353	3.503	284.660	412.672	69.0	9.6	0.780	1	81.3	117.8
ANK	1997	oim	oshima	6	162	2.017	102.669	129.088	79.5	5.5	0.281	1	50.9	64.0
JTA	1997	isg	ishigaki	6	2171	0.996	91.940	136.508	57.2	2.7	0.252	1	92.3	137.1
JS	1997	asj	amamioshima	6	1436	0.718	68.656	116.918	58.7	2.0	0.188	1	95.6	162.8
JTA	1997	mmy	miyakojima	6	2020	0.719	78.655	107.922	72.9	2.0	0.215	1	109.4	150.1
ANK	1997	mye	miyakejima	6	227	1.222	50.816	78.208	65.0	3.3	0.139	1	41.6	64.0
JTA	1997	ueo	kumejima	6	1888	0.145	15.483	20.16	76.8	0.4	0.042	1	106.8	139.0
Average					**1180**	**1.331**	**98.983**	**143.068**	**68.4**	**3.6**	**0.271**	**1**	**82.6**	**107.5**
Average of the whole Tokyo routes					**907**	**5**	**1071**	**1636**	**65**	**13**	**3**	**2**	**170**	**264**

Source: Author based on the data of the Ministry of Infrastructure, Land and Transport (1997

Appendix K: Matrix of factors on the Tokyo routes by category in 2000

Airlines	year	routes	name	category	stage length	number of departure (000) per year	% of increased number of departure (000)	number of pasengers (000) per year	% of increased number of pasengers (000)	number of supplied seats/yr (000)	% of increased number of supplied seats	load factor	% of increased load factor	number of departure per day	passenger per day (000)
JL/NH/JS/AD	2000	spk	sapporo	1	894	31.812	9.37	8982.063	3.75	13797.69	5.63	65.1	-1.81	87.2	24.608
JL/NH/JS/BC	2000	fuk	fukuoka	1	1041	28.816	6.79	7989.491	5.26	12528.63	5.47	63.8	-0.16	78.9	21.889
JL/NH/JS	2000	osa	osaka	1	514	13.009	18.66	4359.858	16.45	6168.515	18.22	70.7	-1.53	35.6	11.945
JL/NH/JS	2000	oka	okinawa	1	1687	13.062	3.05	3745.444	1.82	5172.126	3.31	72.4	-1.50	35.8	10.261
Average					**1034**	**21.675**	**9.47**	**6269.214**	**6.82**	**9416.74**	**8.16**	**68.0**	**-1.25**	**59.4**	**17.176**
JL/NH/JS	2000	kix	kansai	2	687	10.522	21.42	2325.985	16.87	3622.516	27.99	64.2	-8.68	28.8	6.373
JL/NH/JS	2000	hij	hiroshima	2	790	9.916	21.86	2231.196	7.30	3421.1	13.90	65.2	-5.78	27.2	6.113
JL/NH/JS	2000	koj	kagoshima	2	1111	9.134	10.00	2025.747	3.03	3298.45	4.95	61.4	-1.76	25.0	5.550
JL/NH/JS	2000	kmq	komatsu	2	528	7.609	16.08	2021.863	6.55	2901.855	10.94	69.7	-3.86	20.8	5.539
Average					**779**	**9.295**	**17.34**	**2151.198**	**8.44**	**3310.98**	**14.44**	**65.1**	**-5.02**	**25.5**	**5.894**
JL/NH/JS	2000	kmj	kumamoto	3	1056	7.591	3.55	1550.937	4.45	2391.24	-3.80	64.9	7.27	20.8	4.249
JL/NH	2000	hkd	hakodate	3	786	5.308	-1.92	1398.429	-5.27	2282.289	1.71	61.3	-6.84	14.5	3.831
JL/NH/JS	2000	kmi	miyazaki	3	1023	7.633	14.61	1327.765	5.02	2397.259	15.27	55.4	-8.88	20.9	3.638
JL/NH/JS	2000	ngs	nagasaki	3	1143	7.090	7.78	1507.474	0.99	2482.45	4.43	60.7	-3.34	19.4	4.130
NH	2000	okj	okayama	3	685	3.272	19.99	514.014	19.88	742.381	14.49	69.2	4.69	9.0	1.408
NH/JS	2000	tak	takamatsu	3	711	5.805	-0.55	1173.382	1.81	1696.476	-0.20	69.2	2.06	15.9	3.215
JL/NH	2000	myj	matsuyama	3	859	6.374	13.86	1293.186	4.85	2022.223	2.42	63.9	2.24	17.5	3.543
JL/NH/JS	2000	oit	oita	3	928	7.260	-0.47	1287.451	2.43	2048.2	-2.39	62.9	5.01	19.9	3.527
Average					**899**	**6.292**	**7.11**	**1256.58**	**4.27**	**2007.815**	**3.99**	**63.4**	**0.28**	**17.2**	**3.443**

(table continues on next page)

Airlines	year	routes	name	number of airlines	number of new entrants	max fare	discount max	lowest fare	% diff. of max & low fare
JL/NH/JS/AD	2000	spk	sapporo	4	1	28000	22000	13000	0.54
JL/NH/JS/BC	2000	fuk	fukuoka	4	1	31000	24000	11000	0.65
JL/NH/JS	2000	osa	osaka	3	0	18500	12000	10000	0.46
JL/NH/JS	2000	oka	okinawa	3	0	34500	27000	17000	0.51
Average				**3.5**	**0.5**	**28000**	**21250**	**12750**	**0.54**
JL/NH/JS	2000	kix	kansai	3	0	18500	12000	10000	0.46
JL/NH/JS	2000	hij	hiroshima	3	0	26000	17000	17000	0.35
JL/NH/JS	2000	koj	kagoshima	3	0	33000	17000	17000	0.48
JL/NH/JS	2000	kmq	komatsu	3	0	18500	15000	13000	0.30
Average				**3**	**0**	**24000**	**15250**	**14250**	**0.40**
JL/NH/JS	2000	kmj	kumamoto	3	0	31000	25000	13500	0.56
JL/NH	2000	hkd	hakodate	2	0	26500	18000	9200	0.65
JL/NH/JS	2000	kmi	miyazaki	3	0	31000	19250	16000	0.48
JL/NH/JS	2000	ngs	nagasaki	3	0	33000	21850	17450	0.47
NH	2000	okj	okayama	1	0	25500	15000	12000	0.53
NH/JS	2000	tak	takamatsu	2	0	25000	16650	17000	0.32
JL/NH	2000	myj	matsuyama	2	0	27000	17000	17000	0.37
JL/NH/JS	2000	oit	oita	3	0	30000	18900	12500	0.58
Average				**2.375**	**0**	**28625**	**18956**	**14331**	**0.50**

(table continues on next page)

Airlines	year	routes	name	category	stage length	number of departure (000) per year	% of increased number of departure (000)	number of pasengers (000) per year	% of increased number of pasengers (000)	number of supplied seats/yr (000)	% of increased number of supplied seats	load factor	% of increased load factor	number of departure per day	passenger per day (000)
JL/NH	2000	axt	akita	4	555	4.727	29.47	882.392	8.29	1459.012	17.53	60.5	-7.77	13.0	2.418
NH	2000	toy	toyama	4	570	4.205	14.58	872.164	6.78	1251.09	14.54	69.7	-6.82	11.5	2.389
NH	2000	ubj	yamaguchiub	4	935	3.637	-1.99	670.223	9.86	999.34	0.70	67.1	9.11	10.0	1.836
NH/JS	2000	tks	tokushima	4	703	5.093	2.13	807.927	2.54	1333.834	-0.41	60.6	3.06	14.0	2.213
JL/NH/JS	2000	kcz	kochi	4	824	5.637	10.57	861.112	4.49	1393.842	-1.75	61.8	6.37	15.4	2.359
NH/JS	2000	akj	asahikawa	4	1052	4.783	-2.96	735.004	-3.75	1286.226	-2.88	57.1	-1.04	13.1	2.014
NH/JS	2000	aoj	aomori	4	690	5.783	1.12	978.419	-1.21	1502.019	-3.45	65.1	1.88	15.8	2.681
NH/JS	2000	kuh	kushiro	4	1032	3.758	0.13	530.83	-3.24	923.922	-0.09	57.5	-3.04	10.3	1.454
Average					**795**	**4.703**	**6.63**	**792.2589**	**2.97**	**1268.661**	**3.03**	**62.4**	**0.22**	**12.9**	**2.171**
NH	2000	ygj	yonago	5	776	2.867	-1.34	364.843	4.44	600.258	4.61	60.8	-0.16	7.9	1.000
JS	2000	izo	izumo	5	801	3.078	-0.19	498.303	4.26	731.433	-1.90	68.1	6.24	8.4	1.365
JL/NH/JS	2000	mmb	memanbetsu	5	1156	3.078	-4.08	498.76	-2.66	875.741	-0.82	57.0	-1.72	8.4	1.366
JL/JS	2000	obo	obihiro	5	999	2.895	-0.86	525.311	-2.14	853.287	1.57	61.6	-3.60	7.9	1.439
NH	2000	syo	shonai	5	489	2.163	-0.83	366.093	5.19	536.988	-4.81	68.2	10.53	5.9	1.003
NH	2000	ttj	tottori	5	667	2.188	1.25	331.49	4.59	516.6	6.89	64.2	-2.13	6.0	0.908
JS	2000	kkj	kitakyushu	5	958	1.946	36.27	158.818	30.22	260.764	36.27	60.9	-4.40	5.3	0.435
JS	2000	msj	misawa	5	685	2.836	-2.17	430.397	-0.81	763.552	3.83	56.4	-4.41	7.8	1.179
JS	2000	shm	nankishirahar	5	634	1.856	27.21	142.962	15.98	256.802	31.35	55.7	-11.73	5.1	0.392
ANK	2000	onj	odatenoshiro	5	628	1.248	23.08	106.702	13.26	187.65	11.91	56.9	1.25	3.4	0.292
NH	2000	hsg	saga	5	1130	1.458	0.41	166.03	-7.66	280.6	-13.93	59.2	7.25	4.0	0.455
NH	2000	wkj	wakkanai	5	1195	1.014	-1.07	155.327	-11.15	262.035	0.31	59.3	-11.49	2.8	0.426
ANK	2000	shb	nakashibetsu	5	1118	1.437	8.70	109.672	-12.02	219.537	-3.00	50.0	-9.26	3.9	0.300
NH	2000	gaj	yamagata	5	441	0.728	-14.75	72.258	-37.37	125.396	-26.64	57.6	-40.98	2.0	0.198
ANK	2000	iwj	iwami	5	907	1.447	12.78	102.083	-7.43	240.107	13.12	42.5	-18.27	4.0	0.280
Average					**839**	**2.016**	**5.63**	**268.6033**	**-0.22**	**447.3833**	**3.92**	**58.6**	**-5.53**	**5.5**	**0.736**
ANK	2000	hac	hachijyojima	6	353	2.859	-20.27	236.04	-10.48	436.762	6.67	54.0	-16.15	7.8	0.647
ANK	2000	oim	oshima	6	162	2.030	-2.64	90.275	-10.02	129.872	-2.61	69.5	-7.58	5.6	0.247
JTA	2000	isg	ishigaki	6	2171	0.954	-1.55	116.232	1.23	143.117	-0.52	71.7	1.85	2.6	0.318
JS	2000	asj	amamioshima	6	1436	0.718	-1.91	72.84	11.60	116.985	-1.91	62.3	13.89	2.0	0.200
JTA	2000	mmy	miyakojima	6	2020	0.724	0.56	84.004	4.19	120.038	0.46	70.0	3.70	2.0	0.230
JTA	2000	ueo	kumejima	6	1888	0.237	-0.42	25.402	5.76	35.55	-1.77	71.5	7.68	0.6	0.070
Average					**1338**	**1.254**	**-4.37**	**104.1322**	**0.38**	**163.7207**	**0.05**	**66.5**	**0.57**	**3.4**	**0.285**

(table continues on next page)

Airlines	year	routes	name	number of airlines	number of new entrants	max fare	discount max	lowest fare	% diff. of max & low fare
JL/NH	2000	axt	akita	2	0	20500	15000	12000	0.41
NH	2000	toy	toyama	1	0	18500	15000	10000	0.46
NH	2000	ubj	yamaguchiub	1	0	29000	23500	16000	0.45
NH/JS	2000	tks	tokushima	2	0	25000	20000	16000	0.36
JL/NH/JS	2000	kcz	kochi	3	0	26500	17600	17600	0.34
NH/JS	2000	akj	asahikawa	2	0	34000	26500	11700	0.66
NH/JS	2000	aoj	aomori	2	0	25500	20000	8750	0.66
NH/JS	2000	kuh	kushiro	2	0	33000	26000	11200	0.66
Average				**1.875**	**0**	**26500**	**20450**	**12906**	**0.50**
NH	2000	ygj	yonago	1	0	26500	21500	20000	0.25
JS	2000	izo	izumo	1	0	26500	21500	9100	0.66
JL/NH/JS	2000	mmb	memanbetsu	3	0	35000	24500	12300	0.65
JL/JS	2000	obo	obihiro	2	0	32500	22500	11200	0.66
NH	2000	syo	shonai	1	0	17000	14000	12500	0.26
NH	2000	ttj	tottori	1	0	25500	21000	19000	0.25
JS	2000	kkj	kitakyushu	1	0	31000	10720	10720	0.65
JS	2000	msj	misawa	1	0	25000	20000	8700	0.65
JS	2000	shm	nankishirahar	1	0	24500	24500	24500	0.00
ANK	2000	onj	odatenoshiro	1	0	23500	19000	19000	0.19
NH	2000	hsg	saga	1	0	31000	23000	21500	0.31
NH	2000	wkj	wakkanai	1	0	36500	30000	19000	0.48
ANK	2000	shb	nakashibetsu	1	0	35000	27500	27500	0.21
NH	2000	gaj	yamagata	1	0	15000	13000	12500	0.17
ANK	2000	iwj	iwami	1	0	30500	25000	17500	0.43
Average				**1.2**	**0**	**27667**	**21181**	**16335**	**0.39**
ANK	2000	hac	hachijyojima	1	0	16500	13000	13000	0.21
ANK	2000	oim	oshima	1	0	10500	8400	8400	0.20
JTA	2000	isg	ishigaki	1	0	53500	26900	17950	0.66
JS	2000	asj	amamioshima	1	0	39500	13700	13700	0.65
JTA	2000	mmy	miyakojima	1	0	49000	33400	16700	0.66
JTA	2000	ueo	kumejima	1	0	44000	28800	24200	0.45
Average				**1**	**0**	**35500**	**20700**	**15658**	**0.47**

Source: Author based on the data of the Ministry of Infrastructure, Land and Transport (2000)

Appendix L: Matrix of factors on the Tokyo routes by category in 2001

airlines	year	routes	name	category	stage length	number of departure (thousands)	% of increased number of departure(thousands)	number of pasengers(thousands)	% of increased number of pasengers(thousands)	number of supplied seats (thousands)	%of increased number of supplied seats	load factor	% of increased load factor
JL/NH/JS/AD	2001	spk	sapporo	1	894	32.338	1.65	9367.334	4.29	13843.83	0.33	67.7	3.99
JL/NH/JS/BC	2001	fuk	fukuoka	1	1041	30.998	7.57	8274.732	3.57	12996.56	3.73	63.7	-0.16
JL/NH/JS	2001	osa	osaka	1	514	14.612	12.32	4964.395	13.87	6848.926	11.03	72.5	2.55
JL/NH/JS/JTA	2001	oka	okinawa	1	1687	14.408	10.30	3913.802	4.50	5719.925	10.59	68.4	-5.52
Average					**1034**	**23.089**	**7.96**	**6630.066**	**6.56**	**9852.31**	**6.42**	**68.1**	**0.21**
JL/NH/ANK	2001	kix	kansai	2	687	11.316	7.55	2382.913	2.45	3401.707	-6.10	70.1	9.19
JL/NH/JS	2001	hij	hiroshima	2	790	10.901	9.93	2317.884	3.89	3568.778	4.32	64.9	-0.46
JL/NH/JS	2001	koj	kagoshima	2	1111	9.532	4.36	2111.348	4.23	3356.718	1.77	62.9	2.44
JL/NH/JS	2001	kmq	komatsu	2	528	8.006	5.22	2042.866	1.04	2969.222	2.32	68.8	-1.29
Average					**779**	**9.939**	**6.76**	**2213.753**	**2.90**	**3324.106**	**0.58**	**66.7**	**2.47**
JL/NH/JS	2001	kmj	kumamoto	3	1056	8.315	9.54	1616.606	4.23	2532.692	5.92	63.8	-1.69
JL/NH	2001	hkd	hakodate	3	786	5.087	-4.16	1496.33	7.00	2310.009	1.21	64.8	5.71
JL/NH/JS	2001	kmi	miyazaki	3	1023	8.098	6.09	1356.121	2.14	2591.532	8.10	52.3	-5.60
JL/NH/JS	2001	ngs	nagasaki	3	1143	7.272	2.57	1479.618	-1.85	2464.041	-0.74	60.0	-1.15
NH	2001	okj	okayama	3	685	3.645	11.40	604.887	17.68	863.696	16.34	70.0	1.16
NH/JS	2001	tak	takamatsu	3	711	5.806	0.02	1181.903	0.73	1775.604	4.66	66.6	-3.76
JL/NH	2001	myj	matsuyama	3	859	6.538	2.57	1341.727	3.75	2186.04	8.10	61.4	-3.91
JL/NH/JS	2001	oit	oita	3	928	7.279	0.26	1247.256	-3.12	1930.758	-5.73	64.6	2.70
Average					**899**	**6.505**	**3.54**	**1290.556**	**3.82**	**2081.797**	**4.73**	**62.9**	**-0.82**

(table continues on next page)

airlines	year	routes	name	number of airlines	number of new entrants	max fare	discount max	lowest fare	increased % of the highest fare per previous year	increased % of discount max per previous year	increased % of the lowest fare per previous year	different%of max and lowfare	HHI
JL/NH/JS/AD	2001	spk	sapporo	4.0	1	28000	22000	12000	0.00	0.00	-7.69	0.57	0.30
JL/NH/JS/BC	2001	fuk	fukuoka	4.0	1	31000	24000	9900	0.00	0.00	-10.00	0.68	0.30
JL/NH/JS	2001	osa	osaka	3.0	0	18500	14000	10000	0.00	16.67	0.00	0.46	0.35
JL/NH/JS/JTA	2001	oka	okinawa	4.0	0	34500	27000	18000	0.00	0.00	5.88	0.48	0.37
Average				**3.8**	**0.5**	**28000**	**21750**	**12475**	**0.00**	**4.17**	**-2.95**	**0.55**	**0.33**
JL/NH/ANK	2001	kix	kansai	3.0	0	18500	12000	9000	0.00	0.00	-10.00	0.51	0.49
JL/NH/JS	2001	hij	hiroshima	3.0	0	26000	18000	11000	0.00	5.88	-35.29	0.58	0.40
JL/NH/JS	2001	koj	kagoshima	3.0	0	33000	20500	20500	0.00	20.59	20.59	0.38	0.37
JL/NH/JS	2001	kmq	komatsu	3.0	0	18500	15000	13000	0.00	0.00	0.00	0.30	0.35
Average				**3.0**	**0**	**24000**	**16375**	**13375**	**0.00**	**6.62**	**-6.18**	**0.44**	**0.40**
JL/NH/JS	2001	kmj	kumamoto	3.0	0	31000	25000	19000	0.00	0.00	40.74	0.39	0.35
JL/NH	2001	hkd	hakodate	2.0	0	26500	18000	9400	0.00	0.00	2.17	0.65	0.50
JL/NH/JS	2001	kmi	miyazaki	3.0	0	31000	24000	14000	0.00	24.68	-12.50	0.55	0.41
JL/NH/JS	2001	ngs	nagasaki	3.0	0	33000	25500	23900	0.00	16.70	36.96	0.28	0.36
NH	2001	okj	okayama	1.0	0	25500	16000	14000	0.00	6.67	16.67	0.45	1.00
NH/JS	2001	tak	takamatsu	2.0	0	25000	19000	17000	0.00	14.11	0.00	0.32	0.50
JL/NH	2001	myj	matsuyama	2.0	0	27000	21500	21500	0.00	26.47	26.47	0.20	0.60
JL/NH/JS	2001	oit	oita	3.0	0	30000	23500	21500	0.00	24.34	72.00	0.28	0.34
Average				**2.4**	**0**	**28625**	**21563**	**17538**	**0.00**	**14.12**	**22.81**	**0.39**	**0.51**

(table continues on next page)

airlines	year	routes	name	category	stage length	number of departure (thousands)	% of increased number of departure(thousands)	number of pasengers(thousands)	% of increased number of pasengers(thousands)	number of supplied seats (thousands)	%of increased number of supplied seats	load factor	% of increased load factor
JL/NH	2001	axt	akita	4	555	5.086	7.59	962.645	9.09	1477.11	1.24	65.2	7.77
NH	2001	toy	toyama	4	570	4.349	3.42	860.314	-1.36	1240.548	-0.84	69.3	-0.57
NH	2001	ubj	yamaguchiube	4	935	3.643	0.16	701.656	4.69	1025.734	2.64	68.4	1.94
NH/JS	2001	tks	tokushima	4	703	5.094	0.02	809.412	0.18	1345.683	0.89	60.1	-0.83
JL/NH/JS	2001	kcz	kochi	4	824	5.827	3.37	877.276	1.88	1348.362	-3.26	65.1	5.34
NH/JS	2001	akj	asahikawa	4	1052	4.742	-0.86	769.605	4.71	1236.837	-3.84	62.2	8.93
NH/JS	2001	aoj	aomori	4	690	5.772	-0.19	960.146	-1.87	1546.288	2.95	62.1	-4.61
NH/JS	2001	kuh	kushiro	4	1032	3.759	0.03	552.078	4.00	899.046	-2.69	61.4	6.78
Average					**795**	**4.784**	**1.69**	**811.642**	**2.67**	**1264.951**	**-0.37**	**64.2**	**3.09**
NH	2001	ygj	yonago	5	776	2.916	1.71	371.877	1.93	579.95	-3.38	64.1	5.43
JS	2001	izo	izumo	5	801	3.033	-1.46	490.808	-1.50	693.895	-5.13	70.7	3.82
JL/JS	2001	mmb	memanbetsu	5	1156	2.9	-5.78	512.488	2.75	802.649	-8.35	63.8	11.93
JL/JS	2001	obo	obihiro	5	999	2.909	0.48	558.245	6.27	842.582	-1.25	66.3	7.63
NH	2001	syo	shonai	5	489	2.187	1.11	348.408	-4.83	498.946	-7.08	69.8	2.35
NH	2001	ttj	tottori	5	667	2.17	-0.82	321.688	-2.96	468.583	-9.29	68.7	7.01
JS	2001	kkj	kitakyushu	5	958	2.077	6.73	183.557	15.58	278.318	6.73	66.0	8.37
JS	2001	msj	misawa	5	685	2.852	0.56	441.373	2.55	753.585	-1.31	58.6	3.90
JS	2001	shm	nankishirahama	5	634	1.798	-3.13	140.421	-1.78	245.259	-4.49	57.3	2.87
ANK	2001	onj	odatenoshiro	5	628	1.447	15.95	120.803	13.22	208.458	11.09	58.0	1.93
NH	2001	hsg	saga	5	1130	1.458	0.00	169.513	2.10	256.07	-8.74	66.2	11.82
NH	2001	wkj	wakkanai	5	1195	1.023	0.89	168.293	8.35	262.741	0.27	64.1	8.09
ANK	2001	shb	nakashibetsu	5	1118	1.441	0.28	119.886	9.31	216.839	-1.23	55.3	10.60
ANK	2001	mbe	monbetsu	5	1233	0.723	33.39	52.201	33.27	91.076	30.59	57.3	1.96
NH	2001	gaj	yamagata	5	441	0.726	-0.27	55.892	-22.65	121.824	-2.85	45.9	-20.31
NH	2001	iwj	iwami	5	907	1.455	0.55	112.692	10.39	217.459	-9.43	51.8	21.88
Average					**864**	**1.945**	**3.14**	**260.509**	**4.50**	**408.640**	**-0.87**	**61.5**	**5.58**
ANK	2001	hac	hachijyojima	6	353	2.712	-5.14	252.525	6.98	455.109	4.20	55.5	2.78
ANK	2001	oim	oshima	6	162	2.049	0.94	87.914	-2.62	120.275	-7.39	73.1	5.18
JTA	2001	isg	ishigaki	6	2171	0.964	1.05	118.173	1.67	144.3	0.83	74.1	3.35
JS	2001	asj	amamioshima	6	1436	0.727	1.25	88.281	21.20	118.513	1.31	74.5	19.58
JTA	2001	mmy	miyakojima	6	2020	0.725	0.14	86.498	2.97	120.784	0.62	71.6	2.29
JTA	2001	ueo	kumejima	6	1888	0.236	-0.42	23.102	-9.05	36.383	2.34	63.5	-11.19
Average					**1338**	**1.236**	**-0.36**	**109.416**	**3.53**	**165.894**	**0.32**	**68.7**	**3.66**

(table continues on next page)

airlines	year	routes	name	number of airlines	number of new entrants	max fare	discount max	lowest fare	increased % of the highest fare per previous year	increased % of discount max per previous year	increased % of the lowest fare per previous year	different%of max and lowfare	HHI
JL/NH	2001	axt	akita	2.0	0	20500	15000	10500	0.00	0.00	-12.50	0.49	0.52
NH	2001	toy	toyama	1.0	0	18500	15000	10000	0.00	0.00	0.00	0.46	1.00
NH	2001	ubj	yamaguchiube	1.0	0	29000	18000	17000	0.00	-23.40	6.25	0.41	1.00
NH/JS	2001	tks	tokushima	2.0	0	25000	20000	16000	0.00	0.00	0.00	0.36	0.54
JL/NH/JS	2001	kcz	kochi	3.0	0	26500	21000	19800	0.00	19.32	12.50	0.25	0.35
NH/JS	2001	akj	asahikawa	2.0	0	34000	28000	10000	0.00	5.66	-14.53	0.71	0.61
NH/JS	2001	aoj	aomori	2.0	0	25500	20500	20000	0.00	2.50	128.57	0.22	0.57
NH/JS	2001	kuh	kushiro	2.0	0	33000	27000	10000	0.00	3.85	-10.71	0.70	0.53
Average				**1.9**	**0**	**26500**	**20563**	**14163**	**0.00**	**0.99**	**13.70**	**0.45**	**0.64**
NH	2001	ygj	yonago	1.0	0	26500	21500	20000	0.00	0.00	0.00	0.25	1.00
JS	2001	izo	izumo	1.0	0	26500	21500	9000	0.00	0.00	-1.10	0.66	1.00
JL/JS	2001	mmb	memanbetsu	2.0	0	35000	24500	12500	0.00	0.00	1.63	0.64	0.68
JL/JS	2001	obo	obihiro	2.0	0	32500	22750	10000	0.00	1.11	-10.71	0.69	0.64
NH	2001	syo	shonai	1.0	0	17000	14000	12500	0.00	0.00	0.00	0.26	1.00
NH	2001	ttj	tottori	1.0	0	25500	21000	19000	0.00	0.00	0.00	0.25	1.00
JS	2001	kkj	kitakyushu	1.0	0	31000	24000	9000	0.00	123.88	-16.04	0.71	1.00
JS	2001	msj	misawa	1.0	0	25000	20500	9000	0.00	2.50	3.45	0.64	1.00
JS	2001	shm	nankishirahama	1.0	0	24500	17000	9000	0.00	-30.61	-63.27	0.63	1.00
ANK	2001	onj	odatenoshiro	1.0	0	23500	19000	18500	0.00	0.00	-2.63	0.21	1.00
NH	2001	hsg	saga	1.0	0	31000	21000	21000	0.00	-8.70	-2.33	0.32	1.00
NH	2001	wkj	wakkanai	1.0	0	36500	30000	25500	0.00	0.00	34.21	0.30	1.00
ANK	2001	shb	nakashibetsu	1.0	0	35000	26500	24500	0.00	-3.64	-10.91	0.30	1.00
ANK	2001	mbe	monbetsu	1.0	0	36000	26500	25000	0.00	0.00	0.00	0.31	1.00
NH	2001	gaj	yamagata	1.0	0	15000	13000	12500	0.00	0.00	0.00	0.17	1.00
NH	2001	iwj	iwami	1.0	0	30500	24000	19000	0.00	-4.00	8.57	0.38	1.00
Average				**1.1**	**0**	**28188**	**21672**	**16000**	**0.00**	**5.03**	**-3.70**	**0.42**	**0.96**
ANK	2001	hac	hachijyojima	1.0	0	16500	13500	12000	0.00	3.85	-7.69	0.27	1.00
ANK	2001	oim	oshima	1.0	0	10500	8500	8000	0.00	1.19	-4.76	0.24	1.00
JTA	2001	isg	ishigaki	1.0	0	53500	28000	19050	0.00	4.09	6.13	0.64	1.00
JS	2001	asj	amamioshima	1.0	0	39500	10000	10000	0.00	-27.01	-27.01	0.75	1.00
JTA	2001	mmy	miyakojima	1.0	0	49000	29500	17700	0.00	-11.68	5.99	0.64	1.00
JTA	2001	ueo	kumejima	1.0	0	44000	27500	23000	0.00	-4.51	-4.96	0.48	1.00
Average				**1.0**	**0**	**35500**	**19500**	**14958**	**0.00**	**-5.68**	**-5.38**	**0.50**	**1.00**

Source: Author based on the data of the Ministry of Infrastructure, Land and Transport (2001)

Appendix M: Matrix of factors on the Tokyo routes by category in 2003

airlines	year	routes	name	category	stage length	number of departure (thousands)	% of increased number of departure(thousands)	number of pasengers(thousands)	% of increased number of pasengers(thousands)	number of supplied seats (thousands)	%of increased number of supplied seats	load factor	% of increased load factor	number of departure per day
JL/NH/JS/AD	2003	spk	sapporo	1	894	32.150	-4.62	9254.968	-3.70	14400.944	-0.54	64.3	-3.16	88.1
JL/NH/BC	2003	fuk	fukuoka	1	1041	32.751	1.27	8260.565	-1.88	13908.385	0.85	59.4	-2.62	89.7
JL/NH	2003	osa	osaka	1	514	20.058	28.11	6013.526	12.93	9078.784	23.22	66.2	-8.44	55.0
JL/NH	2003	oka	okinawa	1	1687	15.022	2.66	4593.750	4.51	6365.790	8.28	72.2	-3.48	41.2
Average					**1034**	**24.995**	**6.85**	**7030.702**	**2.96**	**10938.476**	**7.96**	**65.5**	**-4.42**	**68.5**
JL/NH	2003	kix	kansai	2	687	10.265	-10.05	1760.423	-18.46	2629.958	-21.24	66.9	3.40	28.1
JL/NH	2003	hij	hiroshima	2	790	13.042	6.41	2528.320	1.98	4497.444	12.84	56.2	-9.65	35.7
NH/JS/BC	2003	koj	kagoshima	2	1111	12.062	0.90	2283.938	-1.78	3888.571	0.96	58.7	-2.81	33.0
JL/NH	2003	kmq	komatsu	2	528	8.005	0.39	2022.766	-1.19	3159.515	5.87	64.0	-6.71	21.9
Average					**779**	**10.844**	**-0.59**	**2148.862**	**-4.86**	**3543.872**	**-0.39**	**61.5**	**-3.94**	**29.7**
NH/JS/SNET	2003	kmj	kumamoto	3	1056	11.443	29.30	1762.104	7.62	2985.868	12.07	59.0	-4.07	31.4
JL/NH	2003	hkd	hakodate	3	786	6.332	11.19	1493.042	-6.51	2507.370	-3.23	59.5	-3.41	17.3
NH/JS/SNET	2003	kmi	miyazaki	3	1023	10.703	12.04	1399.695	0.78	2224.856	-8.71	62.9	10.35	29.3
NH/JS	2003	ngs	nagasaki	3	1143	8.124	-0.49	1471.583	-4.05	2613.985	-0.02	56.3	-4.09	22.3
JL/NH	2003	okj	okayama	3	685	7.287	18.03	1119.884	14.39	1766.095	21.30	63.4	-5.65	20.0
NH/JS	2003	tak	takamatsu	3	711	7.268	0.92	1301.197	2.26	1967.997	-4.22	66.1	6.79	19.9
JL/NH	2003	myj	matsuyama	3	859	7.290	11.42	1410.597	-0.73	2474.397	6.17	57.0	-6.56	20.0
NH/JS	2003	oit	oita	3	928	7.294	0.22	1245.622	-1.87	2069.754	1.59	60.2	-3.37	20.0
Average					**899**	**8.218**	**10.33**	**1400.466**	**1.49**	**2326.290**	**3.12**	**60.6**	**-1.25**	**22.5**

(table continues on next page)

airlines	year	routes	name	nr of airlines	nr of new entrant	max fare	discount max	lowest fare	increased % of the highest fare per previous year	increased % of discount max per previous year	increased % of the lowest fare per previous year	different%of max and lowfare	HHI
JL/NH/JS/AD	2003	spk	sapporo	4	1	25200	22000	9000	-10.00	0.00	0.00	0.64	0.42
JL/NH/BC	2003	fuk	fukuoka	3	1	27900	21000	9800	-10.00	5.00	10.11	0.65	0.41
JL/NH	2003	osa	osaka	2	0	16700	14000	10000	-9.73	0.00	0.00	0.40	0.50
JL/NH	2003	oka	okinawa	2	0	31100	29000	18000	-9.86	7.41	0.00	0.42	0.48
Average				**3**	**0.5**	**25225**	**21500**	**11700**	**-9.90**	**3.10**	**2.53**	**0.53**	**0.45**
JL/NH	2003	kix	kansai	2	0	16700	12000	9000	-9.73	0.00	0.00	0.46	0.52
JL/NH	2003	hij	hiroshima	2	0	23400	16000	13000	-10.00	-11.11	8.33	0.44	0.52
NH/JS/BC	2003	koj	kagoshima	3	1	29700	19500	9800	-10.00	-4.88	10.11	0.67	0.38
JL/NH	2003	kmq	komatsu	2	0	16700	15000	12500	-9.73	0.00	-3.85	0.25	0.50
Average				**2**	**0.25**	**21625**	**15625**	**11075**	**-9.86**	**-4.00**	**3.65**	**0.46**	**0.48**
NH/JS/SNET	2003	kmj	kumamoto	4	1	27900	23500	8500	-10.00	-6.00	-55.26	0.70	0.40
JL/NH	2003	hkd	hakodate	2	0	23900	21000	18000	-9.81	2.44	69.81	0.25	0.51
NH/JS/SNET	2003	kmi	miyazaki	4	1	27900	22000	8500	-10.00	-10.20	0.00	0.70	0.34
NH/JS	2003	ngs	nagasaki	3	0	29700	25000	20000	-10.00	-3.85	-16.67	0.33	0.50
JL/NH	2003	okj	okayama	2	0	23000	13000	10000	-9.80	-23.53	-9.09	0.57	0.60
NH/JS	2003	tak	takamatsu	2	0	22500	18000	17000	-10.00	-5.26	0.00	0.24	0.50
JL/NH	2003	myj	matsuyama	2	0	27000	21500	21500	0.00	0.00	0.00	0.20	0.59
NH/JS	2003	oit	oita	2	0	27000	22500	20000	-10.00	-6.25	-6.98	0.26	0.53
Average				**3**	**0.25**	**26113**	**20813**	**15438**	**-8.70**	**-6.58**	**-2.27**	**0.40**	**0.50**

(table continues on next page)

airlines	year	routes	name	category	stage length	number of departure (thousands)	% of increased number of departure(thousands)	number of pasengers(thousands)	% of increased number of pasengers(thousands)	number of supplied seats (thousands)	%of increased number of supplied seats	load factor	% of increased load factor	number of departure per day
NH/JS(JL)	2003	axt	akita	4	555	5.863	14.94	932.520	-0.33	1615.589	16.09	57.7	-14.14	16.1
JL/NH	2003	toy	toyama	4	570	5.777	7.32	1067.825	2.60	1649.629	6.20	64.7	-3.43	15.8
NH/JL	2003	ubj	yamaguchi	4	935	5.842	15.07	928.494	3.22	1563.845	7.84	59.4	-4.19	16.0
NH/JS/BC	2003	tks	tokushima	4	703	4.891	2.02	796.204	0.33	1313.477	3.08	60.6	-2.73	13.4
JL/NH/JS	2003	kcz	kochi	4	824	6.183	5.37	907.341	2.54	1653.662	21.01	54.9	-15.28	16.9
NH/JS/AD	2003	akj	asahikawa	4	1052	4.896	7.04	817.050	1.54	1325.623	5.72	61.6	-4.05	13.4
(NH)/JS/BC	2003	aoj	aomori	4	690	5.301	-10.94	845.688	-12.89	1450.903	-6.45	58.3	-6.87	14.5
NH/JS	2003	kuh	kushiro	4	1032	3.644	-2.90	558.281	-4.34	889.647	-4.82	62.8	0.64	10.0
Average					**795**	**5.300**	**4.74**	**856.675**	**-0.92**	**1432.797**	**6.08**	**60.0**	**-6.26**	**14.5**
NH	2003	ygj	yonago	5	776	3.432	18.43	369.201	1.85	630.346	12.53	58.6	-9.43	0.0
JS	2003	izo	izumo	5	801	3.626	5.16	517.710	0.93	903.293	19.51	57.3	-15.61	9.9
JS	2003	mmb	memanbet	5	1156	2.995	-0.99	503.609	-4.64	852.870	1.02	59.0	-5.75	8.2
JS	2003	obo	obihiro	5	999	2.927	0.55	517.457	-6.72	843.812	-0.17	61.3	-6.55	8.0
NH	2003	ttj	tottori	5	667	2.658	23.23	310.650	0.72	488.900	13.00	63.5	-10.94	7.3
JS	2003	kkj	kitakyushu	5	958	2.742	2.20	259.662	4.80	367.428	2.20	70.7	2.61	7.5
JS	2003	msj	misawa	5	685	2.121	-17.82	239.355	-34.13	400.982	-27.51	59.7	-9.13	5.8
JS	2003	shm	nankishiral	5	634	1.839	1.21	135.134	-4.12	265.825	5.26	50.8	-8.96	5.0
ANK	2003	onj	odatenoshi	5	628	1.441	-0.14	116.521	-2.24	183.613	-7.18	63.5	5.31	3.9
NH	2003	hsg	saga	5	1130	1.460	0.41	162.605	0.52	244.818	-3.35	66.4	3.91	4.0
NH	2003	wkj	wakkanai	5	1195	1.016	0.30	146.637	-16.50	224.026	-13.08	65.5	-3.82	2.8
ANK	2003	shb	nakashibet	5	1118	0.715	-40.47	90.681	-11.98	143.181	-17.40	63.3	6.57	2.0
ANK	2003	mbe	monbetsu	5	1233	0.726	0.28	49.540	-12.77	91.811	-6.04	54.0	-7.06	2.0
JS	2003	gaj	yamagata	5	441	0.722	71.09	59.633	98.19	103.388	46.09	57.7	35.76	2.0
ANK	2003	iwj	iwami	5	907	0.731	-39.64	59.986	-37.21	94.184	-38.64	63.7	2.41	2.0
Average					**889**	**1.943**	**1.59**	**235.892**	**-1.55**	**389.232**	**-0.92**	**61.0**	**-1.38**	**4.7**
ANK	2003	hac	hachijyojim	6	353	2.770	2.29	221.894	-9.36	450.776	0.80	49.2	-10.05	7.6
ANK/ANET	2003	oim	oshima	6	162	1.547	-24.61	59.381	-18.90	139.047	2.93	42.7	-21.22	4.2
JTA/ANK	2003	isg	ishigaki	6	2171	1.336	19.82	160.109	24.49	186.555	16.95	78.7	5.78	3.7
JS	2003	asj	amamioshi	6	1436	0.880	21.72	93.766	6.90	143.776	22.02	65.2	-12.37	2.4
JTA	2003	mmy	miyakojima	6	2020	0.727	1.39	93.536	10.55	120.032	1.58	77.9	8.80	2.0
JTA	2003	ueo	kumejima	6	1888	0.239	2.58	25.130	12.99	36.564	2.52	58.6	-6.09	0.7
Average					**1338**	**1.250**	**3.86**	**108.969**	**4.45**	**179.458**	**7.80**	**62.1**	**-5.86**	**3.4**

(table continues on next page)

airlines	year	routes	name	nr of airlines	nr of new entrant	max fare	discount max	lowest fare	increased % of the highest fare per previous year	increased % of discount max per previous year	increased % of the lowest fare per previous year	different%of max and lowfare	HHI
NH/JS(JL)	2003	axt	akita	2	0	20500	16000	11000	0.00	6.67	15.79	0.46	0.50
JL/NH	2003	toy	toyama	2	0	18500	14000	10000	0.00	-6.67	-9.09	0.46	0.64
NH/JL	2003	ubj	yamaguchi	2	0	26100	21000	15000	-10.00	0.00	-6.25	0.43	0.53
NH/JS/BC	2003	tks	tokushima	3	1	22500	20000	9800	-10.00	0.00	-42.35	0.56	0.54
JL/NH/JS	2003	kcz	kochi	3	0	23900	20000	17500	-9.81	-6.98	-12.50	0.27	0.50
NH/JS/AD	2003	akj	asahikawa	3	1	30200	25000	9000	-9.85	-9.09	-10.00	0.70	0.57
(NH)/JS/BC	2003	aoj	aomori	2	1	25500	19500	9800	0.00	-4.88	-51.00	0.62	0.74
NH/JS	2003	kuh	kushiro	2	0	29700	26000	23500	-10.00	-3.70	135.00	0.21	0.55
Average				**2**	**0.4**	**24613**	**20188**	**13200**	**-6.21**	**-3.08**	**2.45**	**0.46**	**0.57**
NH	2003	ygj	yonago	1	0	26500	21500	20000	0.00	0.00	0.00	0.25	1.00
JS	2003	izo	izumo	1	0	23900	23000	20500	-9.81	6.98	127.78	0.14	1.00
JS	2003	mmb	memanbet	1	0	31500	27500	25000	-10.00	12.24	78.57	0.21	1.00
JS	2003	obo	obihiro	2	0	29300	25500	23000	-9.85	12.09	130.00	0.22	1.00
NH	2003	ttj	tottori	1	0	25500	21000	19000	0.00	0.00	0.00	0.25	1.00
JS	2003	kkj	kitakyushu	1	0	27900	20500	19000	-10.00	-14.58	111.11	0.32	1.00
JS	2003	msj	misawa	1	0	22500	15300	15300	-10.00	-25.37	-23.50	0.32	1.00
JS	2003	shm	nankishiral	1	0	22100	22100	22100	-9.80	22.78	145.56	0.00	0.54
ANK	2003	onj	odatenoshi	1	0	21200	19500	10600	-9.79	2.63	-42.70	0.50	1.00
NH	2003	hsg	saga	1	0	31000	21000	21000	0.00	16.67	16.67	0.32	1.00
NH	2003	wkj	wakkanai	1	0	36500	30000	29500	0.00	0.00	15.69	0.19	1.00
ANK	2003	shb	nakashibet	1	0	31500	28000	16000	-10.00	7.69	-34.69	0.49	1.00
ANK	2003	mbe	monbetsu	1	0	32400	31600	28700	-10.00	10.88	73.94	0.11	1.00
JS	2003	gaj	yamagata	1	0	15000	13000	7500	0.00	0.00	-40.00	0.50	1.00
ANK	2003	iwj	iwami	1	0	27500	21000	13800	-9.84	-12.50	-27.37	0.50	1.00
Average				**1**	**0**	**26953**	**22700**	**19400**	**-6.61**	**2.63**	**35.40**	**0.29**	**0.97**
ANK	2003	hac	hachijyojim	1	0	16500	16500	16500	0.00	0.00	0.00	0.00	1.00
ANK/ANET	2003	oim	oshima	2	0	10500	7500	7500	0.00	-2.60	-2.60	0.29	0.56
JTA/ANK	2003	isg	ishigaki	2	0	50200	31000	19000	-6.17	10.71	-5.47	0.62	0.66
JS	2003	asj	amamioshi	1	0	35600	35600	35600	-9.87	256.00	256.00	0.00	1.00
JTA	2003	mmy	miyakojima	1	0	45600	29500	18700	-6.94	0.00	0.00	0.59	1.00
JTA	2003	ueo	kumejima	1	0	42900	36650	19000	0.00	0.00	0.00	0.56	1.00
Average				**1**	**0**	**33550**	**26125**	**19383**	**-3.83**	**44.02**	**41.32**	**0.34**	**0.87**

Source: Author based on the data of the Ministry of Infrastructure, Land and Transport (2003)

Appendix N: List of socio-economic indices by prefecture

Data: Statistics Bureau in Japan "Figures of the Tokyo, Hokkaido and all the other prefectures in Japan by statistics in 2005"
http://www.stat.go.jp/data/ssds/5a.htm

Population

1. Population in 2003 (thousands)
2. Non-Japanese population per one hundred thousands
3. Old people population over 65 years old per total population
4. Production population per Total population (15-64 years old)
5. Population increasing ratio
6. Social increasing ratio

Economic activities

7. Income per a capita (prefecture) JYE(000)
8. GDP(prefecture) increasing ratio per previous year
9. Total income(actual) increasing ratio per a previous year
10. Number of the bankruptcy companies in the prefecture
11. CPI increasing ratio per as previous year
12. CPI increasing ratio (transport and communication) per a previous year
13. Standard land price per a previous year

Local government

14. Budget index

Budget index (financial index) shows the financial strength of the local government. It is computed by the average for past three years.

15. Actual profit and loss ratio (%)

It is one of the indexes, which shows the financial management condition of the local government.

16. Current balance ratio

It is the one of the indexes, which interprets the elasticity of the financial structure of the local government.

17. Resident tax per a capita

Labour

18. Perfect unemployment

Number of unemployment / labour population

House holding

19. Monthly actual income per a family

Employment family

20. Monthly consumption expenditure per a family

For whole family

21. Average consumption tendency

The ratio of consumption expenditure per a disposable income

Disposable income= income- (tax+ social insurances)

It shows the psychological tendency to the consumption

22. PC penetration

Per 1000 family

23. Mobile phone penetration

Education

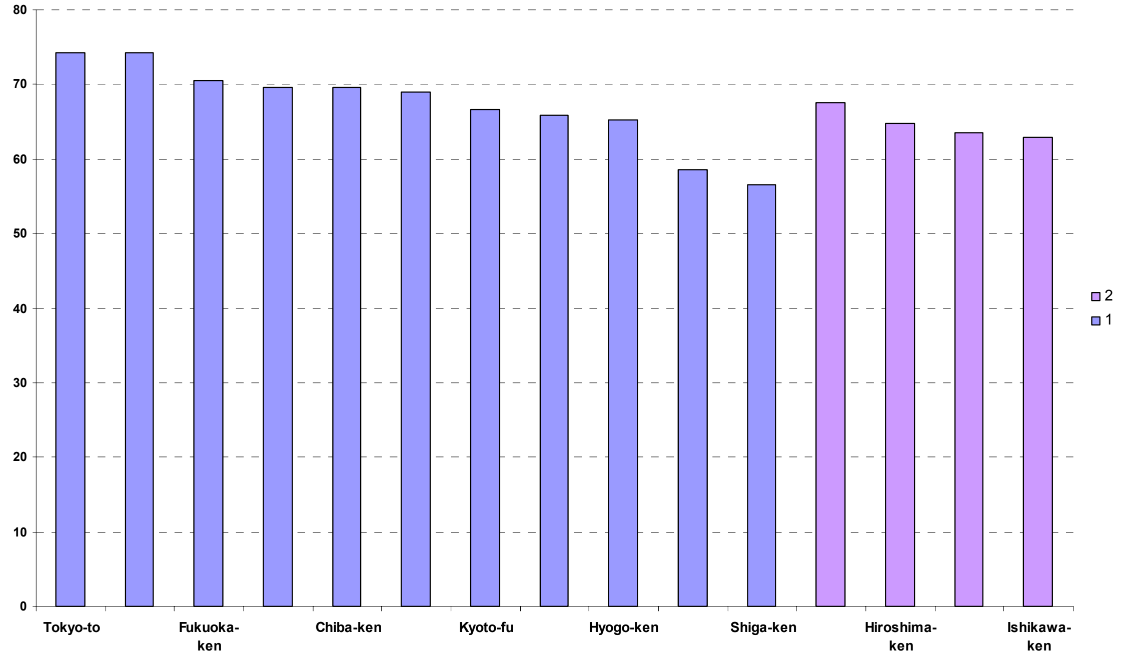
24. Number of university

25. Number of junior college

26. Number of technical college

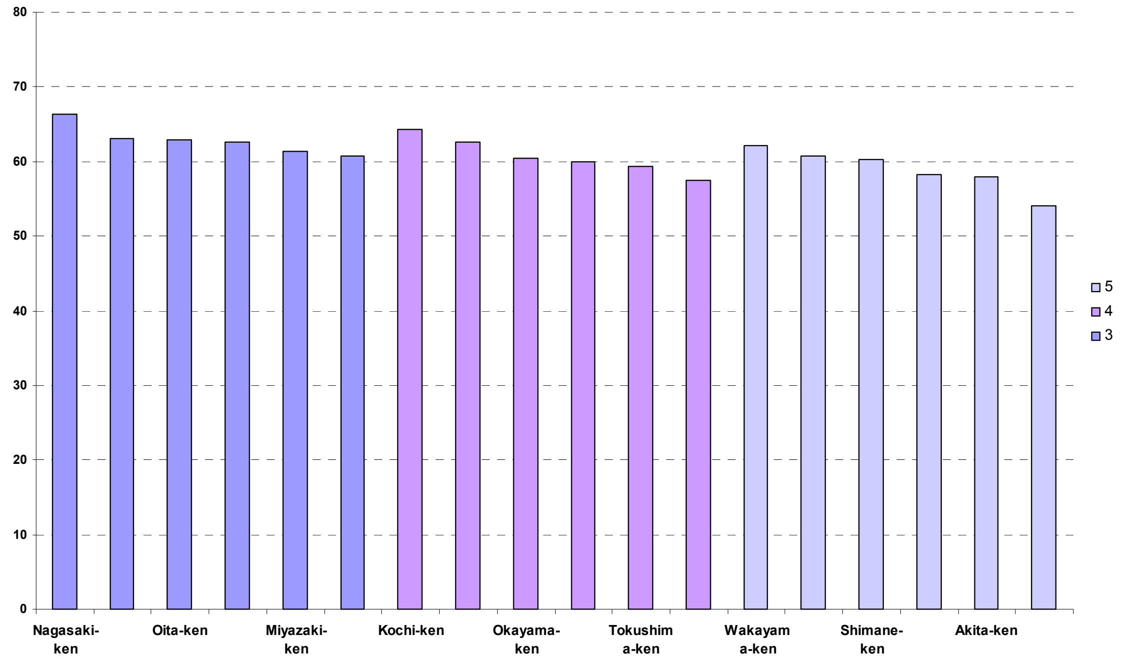
27 Number of other professional school

Appendix O: The tertiary industry labour force proportion by prefecture



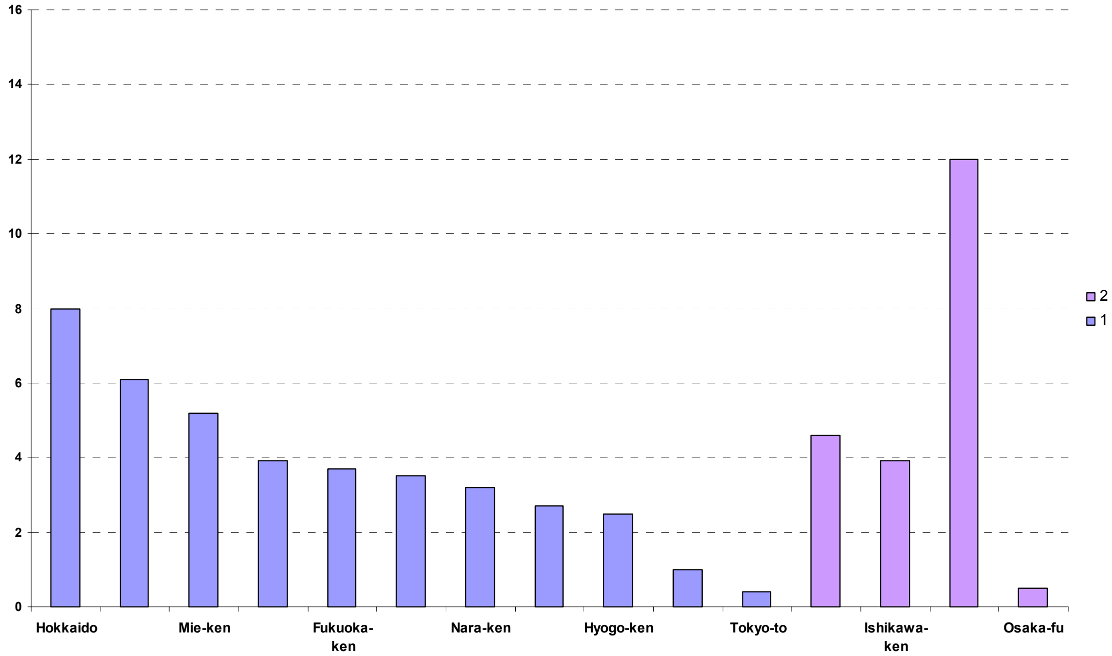
Source: Ministry of Internal Affairs and Communications in Japan (2005)

Note: Number refers to category which each prefecture belongs to.

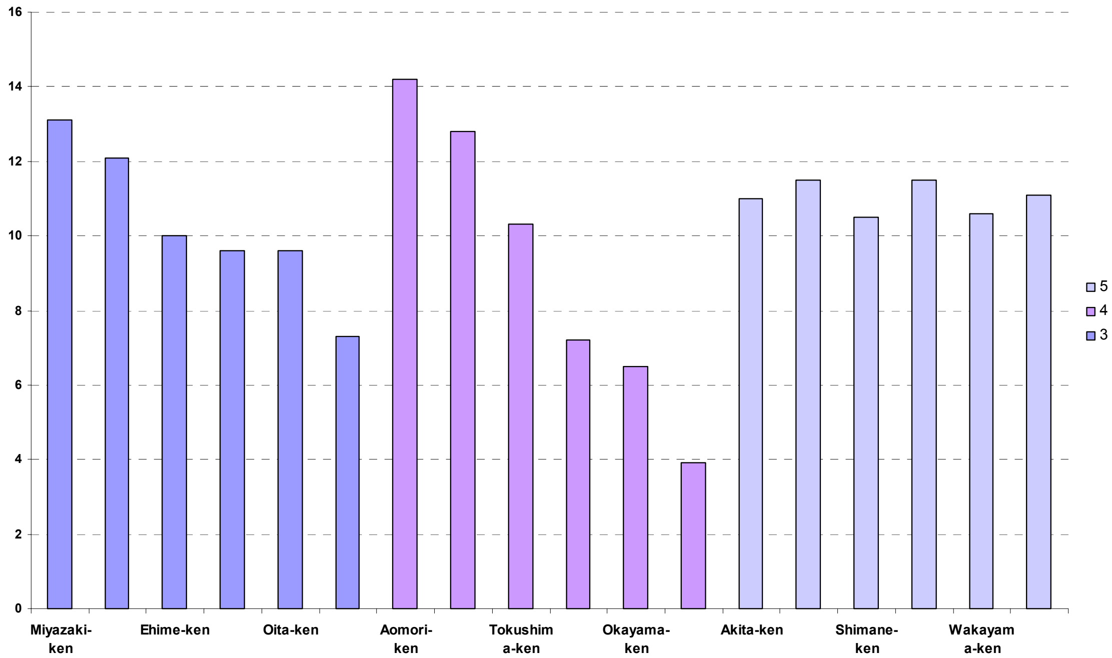


Source: Ministry of Internal Affairs and Communications in Japan (2005)

Appendix P: The primary industry labour force proportion by prefecture

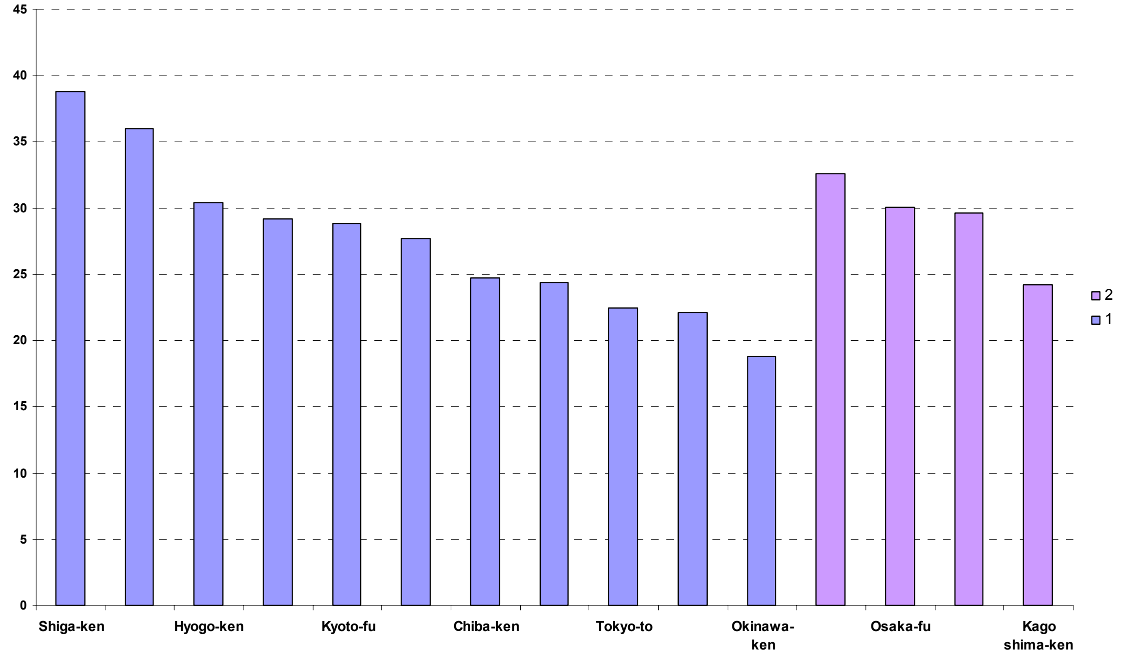


Source: Ministry of Internal Affairs and Communications in Japan (2005)



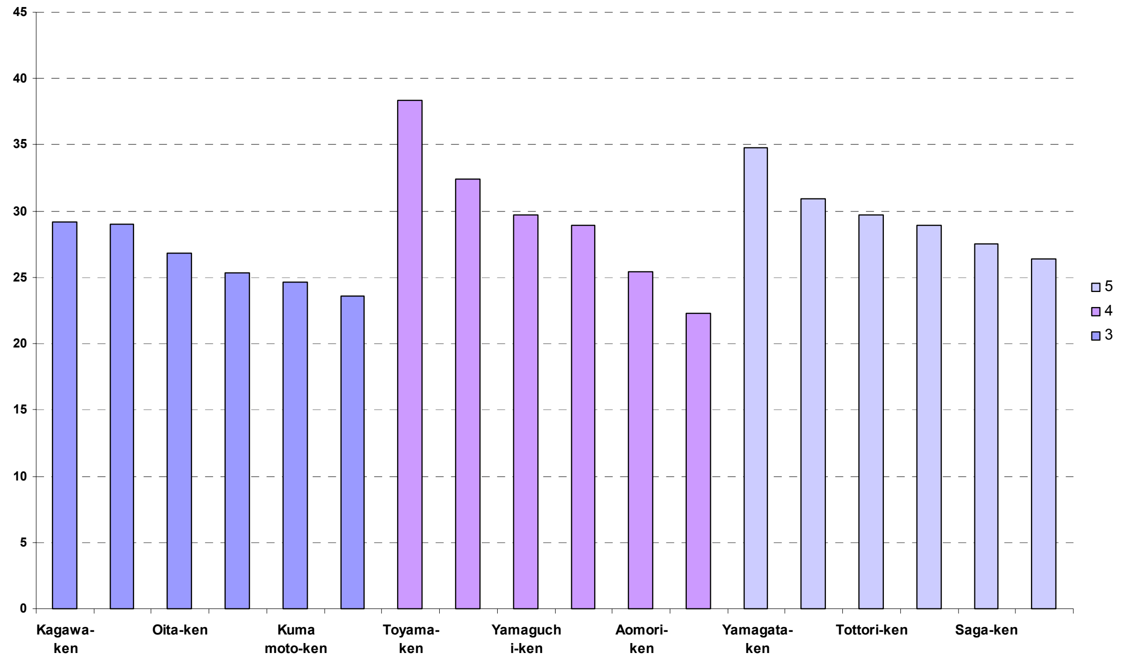
Source: Ministry of Internal Affairs and Communications in Japan (2005)

Appendix Q: The secondary industry labour force proportion by prefecture



Source: Ministry of Internal Affairs and Communications in Japan (2005)

Note: Number refers to category.



Source: Ministry of Internal Affairs and Communications in Japan (2005)

Note: Number refers to category

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Appendix R: Types of fares and prices on selected Tokyo routes in June 2005

Destination from Tokyo	Code	Category	Name of fares	Type of fares	Reservation restrictions		Airlines and fare prices(JYE)		
Sapporo	SPK	1				Schedule	JAL	ANA	ADO
			Normal fare	Fully flexible fare			28,300	28,300	23,000
			Return fare				25,700	25,700	20,000
			Restricted fare 1	Only for limited flights	1days before departures		24,300	24,300	16,000-20,000
			Restricted fare 7	Only for limited flights	7days before departures	morning	16,300-20,300	16300-20300	13,000-18,000
						day time	20,300	20300, 21300	18,000
						evening	16,300-21,300	16300-21300	14,000-19,000
			Advanced purchased fare		21days before departures		18,500, 19,800	18500, 19800	15,000, 16,000
Fukuoka	FUK	1			reservation restrictions		JAL	ANA	SKY
			Normal fare	Fully flexible fare			31,300	31,300	24,000
			Maeuri 1						19,000
			Maeuri 7						17,000
			Restricted fare 1	Only for limited flights	1days before departures		15,800-23,300	15800-23300	15,000-18,000
			Restricted fare 7	Only for limited flights	7days before departures	morning	15,300-19,300	15300-19300	
						day time	19,300	19,300	
						evening	153,00-20,300	15,300-20,300	
			Advanced purchased fare		21days before departures		18,800	18,800	
			Stand by fare		no reservation and only available on departure day				22,000

Destination from Tokyo	Code	Category	Name of fares	Type of fares	Reservation restrictions		Airlines and fare prices(JYE)		
Kansai	KIX	2			reservation restrictions		JAL	ANA	SKY
			Normal fare	Fully flexible fare			18,800	18,800	16,500
			Maeuri 1		1days before departures				13,000
			Shuttle fare	Fully flexible fare	return ticket		14,000	14,000	
			Restricted fare 1	Only for limited flights	1days before departures		9,300-13,300	9,300-14,300	8,500-12,500
			Advanced purchased fare		21days before departures		11,800	11,800	
			Stand by fare		no reservation and only available on departure day				14,500
Kagoshima	KOJ	2			reservation restrictions		JAL	ANA	SKY
			Normal fare	Fully flexible fare			33,300	33,300	25,500
			Maeuri 1		1days before departures				20,000
			Maeuri 7		7days before departures				19,000
			Restricted fare 1	Only for limited flights	1days before departures		26,800	26,800	17,000
			Restricted fare 7	Only for limited flights	7days before departures	morning	22,300	15300-19300	
						day time	20,800, 22,300	22,300	
						evening	19,800, 22,300	19,800, 22,300	
			Advanced purchased fare		21days before departures		21,800	21,800	
			Stand by fare		no reservation and only available on departure day				23,000

(table continues on next page)

Destination from Tokyo	Code	Category	Name of fares	Type of fares	Reservation restrictions		Airlines and fare prices(JYE)		
Kumamoto	KMJ	3			reservation restrictions		JAL	ANA	SNA
			Normal fare	Fully flexible fare			31,300	31,300	22,000
			Restricted fare 1	Only for limited flights	1days before departures		23,300	23,300	
			Restricted fare 7	Only for limited flights	7days before departures	morning	18,300, 19,800	18,300, 19,800	
						day time	19,800	19,800	
						evening	19,800	19,800	
			Advanced purchased fare		21days before departures		19,300	19,300	
			Skynet discount		6days before departures				18,000
			SNA bargain		15days - 2months before departures				9,500
Hakodate	HKD	3			reservation restrictions		JAL	ANA	ADO
			Normal fare	Fully flexible fare			26,800	26,800	21,500
			Restricted fare 1	Only for limited flights	1days before departures		17,300-23,100	17,300-23,100	15,000, 18,500
			Restricted fare 7	Only for limited flights	7days before departures	morning	14,300	14300, 18300	13,000, 17,000
						day time	18,300, 21,800	21,800, 22,800	17,000
						evening	21,800		
			Advanced purchased fare		21days before departures		20,300, 21,300	20,300, 21,300	16,500
Miyazaki	KMI	3			reservation restrictions		JAL	ANA	SNA
			Normal fare	Fully flexible fare			31,000	31,000	22,000
			Restricted fare 1	Only for limited flights	1days before departures		23,300	23,300	
			Restricted fare 7	Only for limited flights	7days before departures	morning	18,800	18,800	
						day time	19,800	19,800	
						evening	19,800	19,800	
			Advanced purchased fare		21days before departures		19,300	19,300	
			Skynet discount		6days before departures				18,000
			SNA bargain		15days - 2months before departures				9,500
Asahikawa	AKJ	4			reservation restrictions		JAL	ANA	ADO
			Normal fare	Fully flexible fare			33,800	33,800	28,000
			Restricted fare 1	Only for limited flights	1days before departures		27,800	27,800	22,000
			Restricted fare 7	Only for limited flights	7days before departures	morning	22,800	22,800	20,000
						day time	22,800	22,800	20,000
						evening	22,800	22,800	20,000
			Advanced purchased fare		21days before departures		22,300	22,300	18,000

Source: Author based on the data from Ministry of Land, Infrastracture and Transport, Aviation statistics in 2005 (see http://www.mlit.go.jp/kisha/kisha05/12/121201/10.pdf)

Notes: All fares are excluding special fuel charge (JYE300), special security charge (JYE300) and Haneda airport charge (JYE100)

Appendix S: Fares and percentage changes of discount fares versus normal fares on Tokyo routes by category in June 2005

Airport code	Airport name	Category	Normal fare	Discount fare(highest)	Discount fare(lowest)	% of discount fare(high)	% of discount fare (low)
FUK	Hakata	1	37000	23600	16600	0.64	0.45
OSA	Shinosaka	1	19100	14600	9600	0.76	0.50
SPK	Sapporo	1	28600	24600	16300	**0.86**	**0.57**
FUK	Fukuoka	1	31300	23600	11000	**0.75**	**0.35**
OKA	Okinawa	1	35100	30800	17600	0.88	0.50
	Average		**30220**	**23440**	**14220**	**0.78**	**0.47**
HIJ	Hiroshima	2	26600	16600	13100	0.62	0.49
KIX	kansai	2	19100	14600	8500	**0.76**	**0.45**
KMQ	Komatsu	2	19000	16100	12100	0.85	0.64
KOJ	Kagoshima	2	33600	27100	11000	**0.81**	**0.33**
	Average		**24575**	**18600**	**11175**	**0.76**	**0.48**
KMJ	Kumamoto	3	31600	23600	9500	**0.75**	**0.30**
NGS	Nagasaki	3	33600	28100	24100	0.84	0.72
TAK	Takamatsu	3	25600	21600	18100	0.84	0.71
HKD	Hakodate	3	27100	23400	14600	0.86	0.54
MYJ	Matsuyama	3	27600	22600	17600	0.82	0.64
OIT	Oita	3	30600	26100	23600	0.85	0.77
KMI	Miyazaki	3	31600	23600	9500	**0.75**	**0.30**
AKJ	Asahikawa	3	33800	28100	20300	**0.83**	**0.60**
	Average		**30188**	**24638**	**17163**	**0.82**	**0.57**

Airport code	Airport name	Category	Normal fare	Discount fare(highest)	Discount fare(lowest)	% of discount fare(high)	% of discount fare (low)
AXT	Akita	4	21100	20600	19600	0.98	0.93
AOJ	Aomori	4	27800	21800	18600	0.78	0.67
OKA	Okayama	4	26100	13600	10600	0.52	0.41
UBJ	Yamaguchiube	4	29600	20300	15600	0.69	0.53
TKS	Tokushima	4	25600	21600	10000	**0.84**	**0.39**
TOY	Toyama	4	19000	12600	10600	0.66	0.56
KCZ	Kochi	4	27100	23900	21600	0.88	0.80
AKJ	Asahikawa	4	33600	28100	21600	**0.84**	**0.64**
KUH	Kushiro	4	33600	29100	27100	0.87	0.81
	Average		**27056**	**21289**	**17256**	**0.78**	**0.64**

GAJ	**Yamagata**	**5**	15600	14100	13600	0.90	0.87
MMB	**Memanbetsu**	**5**	36600	32200	29800	0.88	0.81
KKJ	**Kitakyushu**	**5**	31600	24100	18600	0.76	0.59
OBO	**Obihiro**	**5**	33100	29200	26600	0.88	0.80
IWJ	**Iwami**	**5**	31100	22100	22100	0.71	0.71
IZO	**Izumo**	**5**	27100	23300	20600	0.86	0.76
YGJ	**Yonago**	**5**	27100	23200	21900	0.86	0.81
TTJ	**Tottori**	**5**	26100	22450	21400	0.86	0.82
MSJ	**Misawa**	**5**	25600	15900	15900	0.62	0.62
ONJ	**Odatenoshiro**	**5**	24100	20600	19600	0.85	0.81
HSG	**Saga**	**5**	31600	23600	18600	0.75	0.59
SHB	**Nakashibetsu**	**5**	35600	31000	29400	0.87	0.83
SYO	**Shonai**	**5**	17600	15500	14100	0.88	0.80
GAJ	**Yamagata**	**5**	17000	15000	7500	0.88	0.44
SHM	**anki-shiraham**	**5**	25100	25100	25100	1.00	1.00
WKJ	**Wakkanai**	**5**	37100	32500	31100	0.88	0.84
MBE	**Monbetsu**	**5**	36600	32200	29800	0.88	0.81
NTQ	**Noto**	**5**	19000	16600	15100	0.87	0.79
	Average		**27644**	**23258**	**21156**	**0.84**	**0.76**
HAC	**Hachijyo**	**6**	17000	17000	17000	1.00	1.00
OIM	**Oshima**	**6**	11000	8000	8000	0.73	0.73
ASJ	**Amamioshima**	**6**	41000	28600	27600	0.70	0.67
UEO	**Kumejima**	**6**	44600	21700	20400	0.49	0.46
MMY	**Miyako**	**6**	48600	35500	26500	0.73	0.55
MYE	**Miyakejima**	**6**	13500	13500	13500	1.00	1.00
ISG	**Ishigaki**	**6**	52100	38600	28950	0.74	0.56
	Average		**32543**	**23271**	**20279**	**0.77**	**0.71**
	Total average		**28624**	**22781**	**18258**	**0.81**	**0.65**

Source: Author based of the data from Ministry of Land, Infrastructure and Transport, Aviation statistics in 2005 (see http://www.mlit.go.jp/kisha/kisha05/12/121201/10.pdf)

Notes:

All fares are excluding special fuel charge(JYE300), special security charge(JYE300) and Haneda airport charge(JYE100).

Normal fare means the highest fully flexible fares among operating airlines on each route.

Discount fare(Highest) means the higest discount fares among opearting airlines on each route.

Discount fare(lowest) means the most cheap discount fares among operating airlines on each route.

Shaded rows denote routes entered by new entrants.

Appendix T: List of exchange rate used in this study

The exchange rate adopted in the Representative Rates for Selected Currencies, which was reported in the exchange rate archives by month of the International Monetary Fund. Citing internet resources, http://www.imf.org/external/np/fin/data/param_rms_mth.aspx

	£1	1 Euro	JYE
2000	USD 1.592	USD 0.956	1 USD = JYE 105
2003	USD 1.576	USD 1.089	1 USD = JYE 118
2004	USD 1.85	USD 1.232	1 USD = JYE 104
2005	USD 1.887	USD 1.295	1 USD = JYE 107

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